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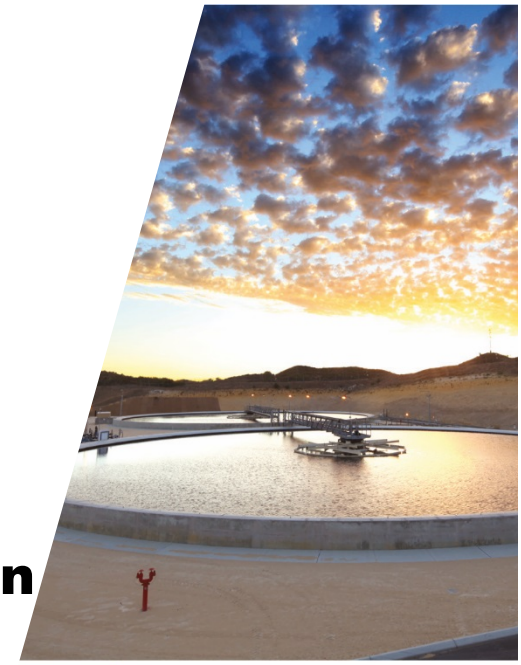

Risk Assessment Assumption Document

South Dayton Dump and Landfill Site
Moraine, Ohio

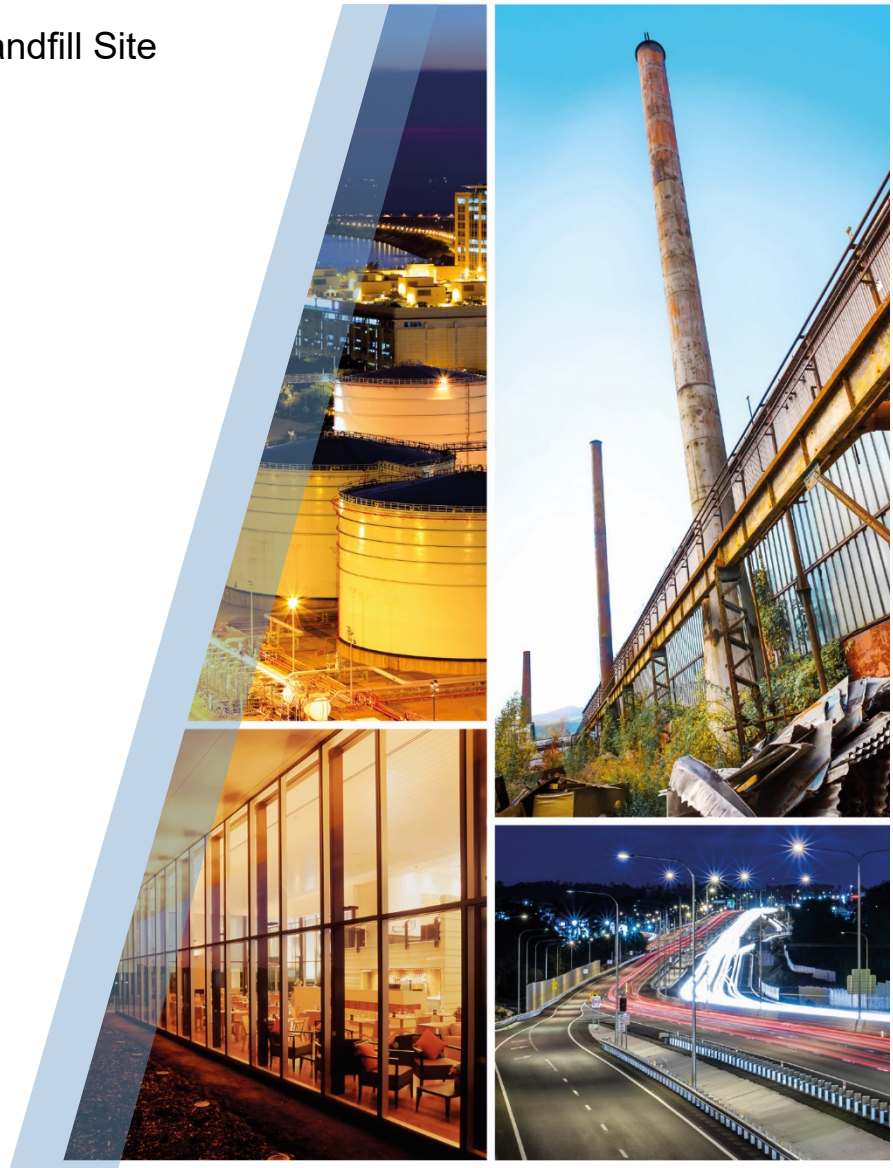

Table of Contents

1. Introduction 1
   - 1.1 Overview 1
   - 1.2 Site Location 1
   - 1.3 General Site Use 2
   - 1.4 Nature and Extent of Contamination 3
   - 1.5 Report Organization 3
2. HHRA Step 1 and Step 2 3
   - 2.1 Introduction 3
     - 2.1.1 Objective of the HHRA 4
     - 2.1.2 Organization of the HHRA 4
   - 2.2 Site Characterization/Hazard Identification 5
     - 2.2.1 HHRA CSM 5
     - 2.2.2 Receptor Characteristics 5
     - 2.2.2.1 Trespasser 5
     - 2.2.2.2 Resident 6
     - 2.2.2.3 Recreational User (Child and Adult) 6
     - 2.2.2.4 Fish Eater (Child and Adult) 6
     - 2.2.2.5 Industrial/Commercial Worker 6
     - 2.2.2.6 Construction/Utility Worker 7
     - 2.2.2.7 Maintenance/Outdoor Worker 7
     - 2.2.3 Data Summary 7
     - 2.2.4 Selection of Chemicals of Potential Concern (COPCs) 9
     - 2.2.4.1 OU1 Soil/Fill 11
     - 2.2.4.1.1 EU 1 11
     - 2.2.4.1.2 EU2 11
     - 2.2.4.1.3 EU3 12
     - 2.2.4.1.4 EU4 13
     - 2.2.4.1.5 EU3-Eu4 14
     - 2.2.4.1.6 EU5-EU8 15
     - 2.2.4.1.7 EU9 16
     - 2.2.4.1.8 EU10 17
     - 2.2.4.1.9 EU11 18
     - 2.2.4.1.10 EU12 19
     - 2.2.4.1.11 EU13 19
     - 2.2.4.1.12 EU14 21
     - 2.2.4.1.13 EU15 22
     - 2.2.4.1.14 EU16 24
     - 2.2.4.1.15 EU17 25
     - 2.2.4.1.16 EU18 –EU19 26
     - 2.2.4.2 OU1 Soil Vapor 26
     - 2.2.4.3 Outside of OU1 Soil Vapor 28
     - 2.2.4.4 OU1 Indoor Air 29
     - 2.2.4.5 OU1 Groundwater 29
     - 2.2.4.6 Quarry Pond 31
     - 2.2.4.7 Floodplain 33
     - 2.2.4.8 Summary of COPC Selection 34

Table of Contents

2.3 Exposure Assessment 35

2.3.1 Characterization of Exposure Setting 35
2.3.1.1 Current Land Use 35
2.3.1.2 Future Land Use 36
2.3.2 Identification of Potential Exposure Pathways 36
2.3.2.1 Release Mechanisms 37
2.3.2.2 Fate and Transport in Receiving Media 37
2.3.2.3 Potential Exposure Points 38
2.3.2.4 Potential Exposure Routes 38
2.3.2.5 Exposure Scenarios and Completed Exposure Pathways 39
2.3.3 Quantification of Exposure 41
2.3.3.1 Exposure Variables 43
2.3.3.2 Specific Intake Equations 44
2.3.3.3 Exposure Scenario Assumptions 48
2.3.4 Evaluation of Non-Residential Adult Exposures to Lead 50
2.3.4.1 Adult Lead Exposure Equation 51
2.3.4.2 Adult Lead Exposure Equation Input Parameters 52
2.3.5 The Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead 53

3. HHRA Step 3 and Step 4 54

3.1 Toxicity Assessment 54

3.1.1 Non-carcinogenic Hazards 54
3.1.2 Carcinogenic Risks 55
3.1.3 Dermal Toxicity 57

3.2 Risk Characterization 57

3.3 Hazard Estimates 58

3.4 Cancer Risk Estimates 59

4. References 60

Figure Index

Figure 1.1 Site Location Map

Figure 1.2 Operable Unit One (OU1) Boundary

Figure 1.3 Exposure Units

Figure 2.1 Conceptual Site Model – Human Health

Table Index

Table 2.1 Summary of Exposure Assumptions

Appendix Index

Appendix A	Risk Assessment Tables (RAGS Part D Format)
Appendix B	ProUCL Input and Output Tables
Appendix C	VISL Calculation for Indoor Air Concentrations
Appendix D	USEPA 1999 Memorandum

Acronyms and Short Forms Index

A	Chemical Concentration in Animal Tissue
ABS	Absorption Factor
AF	Soil to Skin Adherence Factor
AF_S	Ingestion Rate of Soil
AF_W	Ingestion Rate of Water
ALM	Adult Lead Model
AT	Averaging Time
ATSDR	Agency for Toxic Substances and Disease Registry
B	Dimensionless Ratio of Permeability Coefficient of a compound through the Stratum Corneum Relative to its Permeability Coefficient across the Viable Epidermis
bgs	Below Ground Surface
BKSF	Biokinetic Slope Factor
BSAF	Biota to Sediment Accumulation Factor
BW	Body Weight
CalEPA	California Office of Environmental Health Hazard Assessment
CDI	Chronic Daily Intake
CF	Conversion Factor
COPC	Chemicals of Potential Concern
CR	Consumption Rate
CS	Chemical Concentration in Soil/Sediment
CSFs	Cancer Slope Factors
CSM	Conceptual Site Model
CTE	Central Tendency Exposure
CW	Chemical Concentration in Groundwater/Surface Water
DA_{event}	Dose Absorbed per Unit Area per Event
EC	Exposure Concentration
ED	Exposure Duration
EF	Exposure Frequency
EPA	Environmental Protection Agency
EPC	Exposure Point Concentration
ET	Exposure Time
EU	Exposure Unit
F	Fraction of Animal Consumed that is Contaminated
FAQ	Frequently Asked Questions

Acronyms and Short Forms Index

feet BGS	Feet Below Ground Surface
EV	Event Frequency
FA	Fraction Absorbed Water
FT	Fraction Time Exposed
GI	Gastrointestinal
$GSD_{i,adult}$	Adult Blood Lead Concentration Contributed by Exposure to Lead
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IEUBK Model	Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead
IR	Ingestion rate
IRIS	Integrated Risk Information System
IR_S	Ingestion Rate of Soil
IR_w	Ingestion Rate of Water
kg	Kilogram
K_{ow}	Octanol-Water Partition Coefficient
LADD	Lifetime Average Daily Dose
LOAEL	Lowest Observed Adverse Effect Level
MatPb	Mother's Blood Lead Concentration
MDL	Method Detection Limit
mg/kg/day	Milligram per Kilogram per day
mg/m^3	Milligrams per Cubic Meter
ND	Non Detect
NOAEL	No Observed Adverse Effect Level
OEHHA	Office of Environmental Health Hazard Assessment
OSWER	Office of Solid Waste and Emergency Response
PAHs	Polycyclic Aromatic Hydrocarbons
$PbB_{fetal,\ 0.95}$	95th Percentile Target Blood Lead Concentration in the fetus
$PbB_{adult,\ 0}$	Typical Lead Concentration
PbS	Soil Lead Concentration
PbW	Water Lead Concentration
PC	Dermal Permeability Coefficient of Compound in Water
PCB	Polychlorinated Biphenyls
PEF	Particulate Emission Factor
PbB	Target Blood Lead (PbB)
PPRTV	Provisional Peer Reviewed Toxicity Values
RAAD	Risk Assessment Assumption Document
RAGS	Risk Assessment Guidance for Superfund
RfCs	Reference Concentrations
RfDs	Reference Doses

Acronyms and Short Forms Index

$R_{fetal/maternal}$	Mean Ratio of Fetal to Maternal Target Blood Lead
RME	Reasonable Maximum Exposure
RSL	Regional Screening Level
SA	Skin Surface Area
SVOC	Semi Volatile Organic Compounds
tevent	Event Duration
τ_{event}	Lag Time per Event
t*	Time to Reach Steady State
TEQ	Toxic Equivalents
TRW	Technical Review Workgroup
UCL	Upper Confidence Limit
URFs	Unit Risk Factors
USEPA	U.S. Environmental Protection Agency
VISL	Vapor Intrusion Screening Levels
VOC	Volatile Organic Compounds
VF	Volatilization Factor

1. Introduction

This document presents the Risk Assessment Assumption Document (RAAD) which has been prepared for South Dayton Dump and Landfill Site (Site) consistent with the approved Remedial Investigation/Feasibility Study (RI/FS) Work Plan (GHD, 2017).

GHD has prepared this RAAD report on behalf of the Respondents to the Administrative Settlement Agreement and Order on Consent for Remedial Investigation/Feasibility Study for Operable Unit (OU)1 and OU2, United States Environmental Protection Agency (USEPA) Docket No. V-W-16-C-011 (Respondents).

1.1 Overview

The purpose of the RAAD is to document the initial components of the Human Health Risk Assessment (HHRA) and facilitate coordination between the agencies and the Respondents during completion of the baseline HHRA.

The HHRA process includes the following four key steps as required by the RI/FS work plan: 1) Site Characterization and Hazard Identification; 2) Exposure Assessment; 3) Toxicity Assessment; and 4) Risk Characterization.

Consistent with USEPA risk assessment guidance, the primary components of the RAAD are based on the first two steps and include the following:

- Site Characterization/ Hazard Identification:
  - Conceptual Site Model (CSM)
  - Selection of Constituents of Potential Concern (COPCs)
- Exposure Assessment:
  - Characterization of Exposure Setting
  - Identification of Potential Exposure Pathways
  - Quantification of Exposure

1.2 Site Location

The Site is located on the west side of Dryden Road (also known as Springboro Pike), at 1901 through 2153 Dryden Road and 2225 East River Road in Moraine, Ohio in an area of mixed urban, commercial, industrial, and residential development. The Site location is shown on Figure 1.1 and the Site layout including the OU1 boundary is shown on Figure 1.2. The Site is bounded to the north and west by the Miami Conservancy District (MCD) floodway[1] (part of which is included in the definition of the Site), the Great Miami River (GMR) Recreational Trail and the GMR beyond. The

[1] The MCD defines a floodway as the channel of a river or watercourse and the adjacent land areas that have been reserved in order to pass a specified flood discharge. The floodway is usually characterized by any of the following: moderate to high velocity flood water, high potential for debris and projectile impacts, and moderate to high erosion forces. The MCD floodway is not the same as the 100-year floodway and 100-year floodplain areas at the Site based on FEMA flood insurance maps, which are more extensive than the MCD definition.

Site is bounded to the east by Dryden Road with light industrial facilities beyond, to the southeast by residential and commercial properties along East River Road with a residential trailer park beyond, and to the south by undeveloped land with industrial facilities beyond.

1.3 General Site Use

The area of the Site generally includes a combination of developed and undeveloped land. The northern and central areas include a variety of operating businesses with access along Dryden Road, and open ground within the central area situated between the operating businesses and the MCD floodway. The southern area includes operating businesses with access along East River Road, and the Quarry Pond situated adjacent to the MCD floodway.

The types of operating businesses include asphalt production (Valley Asphalt), truck repair, auto salvage, commercial, and construction as shown in the table below.

Parcel	Business Name	Description
5054	Valley Asphalt	Asphalt batch plant
5171	B&G Equipment & Truck Repair	Truck repair shop
5172	S&J Precision	Metal machining and fabrication
	Overstreet Painting and Drywall	Office/warehouse
	Bullseye Amusements	Vending machine retail and service
5173	Sim Trainer	Office/warehouse – gun range
5174	Command Roofing	Warehouse - storage
5175	Dickinson Construction	Office and storage yard
5176	Sealer and Other Stuff	Parking Parcel with propane and asphalt above ground storage tanks (ASTs)
5175, 5176, and 5177	Vacant	Vacant
4423 and 3753	Jim City Auto Salvage	Automotive garages, automobile scrap and salvage yard
4610	Ronald Barnett Construction	Construction office and equipment storage

Nearby and adjacent businesses present at the time of this report are as follows:

Parcel	Business Name	Description
1041, 2941, 3061, and additional parcels	Dayton Power and Light	Electric Utility Service Yard and repair shops
3207	Globe Equipment	Manufacturing/Office
3254	Middleton Trucking	Truck repair garage
3255	Century Propane	Propane distribution
3256	Jim City Salvage	Automotive garages, automobile scrap and salvage yard

There are also residences in a trailer park (non-responsive) to the southeast across Dryden Road, as well as six residences (non-responsive) adjacent to OU1 along East River Road, and another residence non-responsive on the southeast side of East River Road.

There is a fence around the majority of the central 25 acres (Parcel 5177) while separate fencing encompasses most of the northern and southern parcels that are within the OU1 boundary. The south and western portions of the Quarry Pond are not fenced and there is not a fence between Valley Asphalt and the MCD floodway/recreational trail.

For purposes of the HHRA, the Site within OU1 is divided into exposure units (EUs) based primarily on the property parcels noted above, and shown on Figure 1.3[2].

1.4 Nature and Extent of Contamination

Based on the findings of investigations performed since the mid-1990s, it has been identified that the groundwater, surface water, soil, sediment, and soil vapor beneath and in some cases immediately adjacent to the site are impacted to varying degrees. Information on the nature and extent of contamination will be presented in the RI Report. Detailed information regarding site characterization is included in the following reports:

- Site Characterization Technical Memorandum, Soil/Fill and Soil Gas Investigation, July 17, 2019
- Site Characterization Technical Memorandum, Groundwater Investigation, September 30, 2019
- Site Characterization Technical Memorandum, Quarry Pond Investigation, March 18, 2020

The information within these reports was used in the preparation of the RAAD.

1.5 Report Organization

The remainder of this report is organized as follows:

Section 2.0 presents the information that will be used for the preparation of the baseline HHRA and describes the first two steps, i.e., Site characterization/hazard identification (see Section 2.2), and exposure assessment (see Section 2.3).

Section 3.0 presents information related to the completion of the baseline HHRA, i.e., Step 3 (Toxicity Assessment) and Step 4 (Risk Characterization).

Section 4 includes references.

2. HHRA Step 1 and Step 2

2.1 Introduction

The HHRA will be conducted in accordance with the following United States Environmental Protection Agency (USEPA) guidance:

- USEPA Risk Assessment Guidance for Superfund (RAGS), Volume I, Human Health Evaluation Manual (Part A), EPA/540/1-89/002, December 1989 (USEPA, 1989).

[2] The EU boundaries shown on Figure 1.3 are the same as shown in the RI/FS Work Plan with the exception of EU10 and EU11. These were initially shown to follow the fence line along the west side of each EU, and was modified to follow the property line consistent with other Dryden Road business parcels as reported in the Site Characterization Technical Memorandum for the Soil/Fill and Soil Gas Investigation, July 17, 2019.

- USEPA RAGS Volume I, Human Health Evaluation Manual (Part B, Development of Risk-Based Preliminary Remediation Goals), Interim, EPA/540/R-92/003, Publication 9285.7-01B, December 1991 (USEPA, 1991).
- USEPA Human Health Evaluation Manual Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 6, 2014 (USEPA, 2014).
- USEPA Exposure Factors Handbook 2011 Edition (Final), U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, November 2011 (USEPA, 2011).
- USEPA RAGS Volume I, Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments), Final, Publication 9285.7-47, December 2001 (USEPA. 2001).
- USEPA RAGS Volume I, Human Health Evaluation Manual (Part E, Supplemental Guidance, Dermal Risk Assessment), Final, EPA/540/R/99/005, OSWER 9285.7-02EP, PB99-963312, July 2004 (USEPA, 2004).
- USEPA RAGS Volume I, Human Health Evaluation Manual (Part F, Supplemental Guidance for Inhalation Risk Assessment) Final, EPA-540-R-070-002, January 2009 (USEPA, 2009).
- USEPA Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER Directive 9355.4-24, December 2002 (USEPA, 2002).
- USEPA Region 4 – Region 4 Human Health Risk Assessment Supplemental Guidance, March 2018 Update (USEPA, 2018).

2.1.1 Objective of the HHRA

The objective of the HHRA is to evaluate potential hazards and risks to human receptors both on and off the Site resulting from site conditions in consideration of current land use and reasonably anticipated future land re-use at the site. The specific goals of the HHRA are to:

- Identify and provide analysis of baseline risks (defined as risks that might exist if no remediation were conducted at the Site).
- Provide a basis for determining which media and exposure pathways are contributing to the identified risks/hazards at the Site.
- Provide a basis for determining the level of chemicals that will not adversely impact public health.
- Provide a basis for comparing potential human health impacts of various remedial alternatives.

2.1.2 Organization of the HHRA

The HHRA Report will consist of the following sections:

- Introduction
  - Will present background information relevant to the HHRA, the purpose of the HHRA, and outline the organization of the HHRA.

- Site Characterization/Hazard Identification
  - Will present a summary of the nature and extent of the contamination and hazard identification attributable to the historical operations at the site, the CSM, and the selection of COPCs.
- Exposure Assessment
  - Will present a summary of the exposure settings, identify the potential exposure pathways, and quantify exposure based on the exposure assumptions.
- Toxicity Assessment
  - Will present a summary of the toxicity data used to calculate the non-carcinogenic hazards and carcinogenic risks.
- Risk Characterization
  - Will present an assessment of the potential risks to human health posed by site media and include the uncertainty analysis.

2.2 Site Characterization/Hazard Identification

Site characterization/hazard identification is discussed below in terms of the HHRA CSM (Section 2.2.1), Receptor Characteristics (Section 2.2.2), and selection of COPCs (Section 2.2.3).

2.2.1 HHRA CSM

In order to evaluate the significance of the impacted media at the site, the potential pathways by which individuals may come in contact with these media must be determined. The combination of factors (chemical source, media of concern, release mechanisms, and potential receptors) that could produce a complete exposure pathway and lead to human uptake of chemicals at the site is assessed in what is defined by the CSM. A source and complete pathway are required to potentially create an exposure to a receptor, and therefore possible risk. The objective of the HHRA is to evaluate potential risks to human health from exposure to COPCs via applicable exposure pathways. The Human Health CSM is presented in RAGS Part D Table 1 format. The Human Health CSM for the Site is presented in Table 1 of Appendix A (also Figure 2.1) and the receptor characteristics are presented in the following section.

2.2.2 Receptor Characteristics

2.2.2.1 Trespasser

The trespasser receptor would be an occasional trespasser aged 7 to 16 years, who would gain access to the Site (including multiple OU1 Exposure Units [EUs] and the Quarry Pond) via trespassing. As the exposure frequency for an adolescent trespasser would be equal to or greater than an adult trespasser, only the adolescent trespasser, the more sensitive receptor, will be evaluated within the HHRA. The trespasser is expected to conduct activities at or near the ground surface, and therefore, contact with groundwater will not occur. The potential exposure pathways for the trespasser are dermal contact (through exposed skin), incidental ingestion, and inhalation of airborne volatiles and particulates as contact is made with surface soil within the individual EUs. The

potential exposure pathways for the trespasser while trespassing at the Quarry Pond are dermal contact (through exposed skin) and incidental ingestion as contact is made with sediment and dermal contact (through exposed skin), incidental ingestion, and inhalation of airborne volatiles as contact is made with surface water.

2.2.2.2 Resident

Currently there are no residents within OU1 with the exception of one person that lives in a trailer unit within EU5 located at the non-responsive. The future hypothetical resident would be a child from 1 to 6 years of age and a child/adult from 7 to 26 years of age, who reside on-Site (within OU1 EUs) under a residential use scenario. The potential exposure pathways for the resident are: 1) dermal contact (through exposed skin), incidental ingestion, and inhalation of airborne volatiles and particulates as contact is made with surface and subsurface soil and, 2) groundwater as a tap water source (potable source) in the future household. In addition, the resident may be exposed to indoor air that may be impacted by volatile COPCs present in soil vapor and/or groundwater through inhalation pathway.

Due to the proximity of the resident to the Quarry Pond, an adolescent resident may be considered a trespasser. Exposure of the trespasser to the Quarry Pond surface water and sediment could occur as discussed under the trespasser receptor scenario. This trespasser could potentially catch fish from the Quarry Pond while trespassing and bring the fish home for the family to eat. Exposure via ingestion of the fish is considered under the fish eater scenario (described below).

2.2.2.3 Recreational User (Child and Adult)

The recreational user would be a child from 1 to 6 years of age and a child/adult from 7 to 26 years of age, who would gain access to the Great Miami River Floodplain area adjacent to the existing bike/walking path. The potential exposure pathways for the recreational user are dermal contact (through exposed skin) and incidental ingestion and inhalation of airborne volatiles and particulates as contact is made with surface soil.

2.2.2.4 Fish Eater (Child and Adult)

The fish eater receptor would be a child and adult who consumes fish caught from within the Quarry Pond by an adolescent trespasser. The fish eater is considered to consume these fish at a low frequency and not for subsistence purposes. A low frequency of one meal of fish per month during April to November has been assumed given that the Quarry Pond is on private property and the person will be trespassing to catch the fish.

2.2.2.5 Industrial/Commercial Worker

The industrial/commercial worker would be an adult working primarily indoors (and possibly a limited amount outdoors). It is expected that the industrial/commercial worker would be exposed to indoor air that may be affected by volatile COPCs present in soil vapor and groundwater, while working indoors. During the limited outdoor activities, dermal contact (through exposed skin on the head, hands, and forearms), incidental ingestion, and inhalation of airborne particulates and volatiles could occur as contact is made with surface soil and subsurface soil. Note that the potential exposure to

volatile COPCs through VI to indoor air was previously assessed resulting in implementation of VI mitigation for seven existing buildings.

2.2.2.6 Construction/Utility Worker

Outdoor construction activities may occur during future development of the Site. The construction/utility worker is an adult that would be conducting limited ground intrusive activities (i.e., during maintenance of a subsurface utility for example) to a depth that could expose the worker to soil/fill and potentially groundwater if present within the excavation. The presence of impacted groundwater may result in potential incidental ingestion (hand to mouth contact), dermal contact, and inhalation/dermal contact of groundwater vapors accumulating within an excavated trench. The construction/utility worker could also be potentially exposed to soil through incidental ingestion and dermal contact with exposed skin. Inhalation and dermal contact of volatile COPCs in ambient air emitted from soil or COPCs within windblown particulates could also occur during work completed in the immediate vicinity of the excavation. In addition, the construction/utility worker may be exposed to Quarry Pond sediment and surface water. The potential exposure pathways for the construction/utility worker are dermal contact (through exposed skin) and incidental ingestion as contact is made with sediment and dermal contact (through exposed skin), incidental ingestion, and inhalation of airborne volatiles as contact is made with surface water.

Thus, a construction/utility worker direct contact exposure to soil, groundwater, sediment, and surface water was evaluated in the preliminary HHRA. The groundwater is located at greater than 15 feet below ground surface in the majority of the EUs, therefore the construction/utility worker will not be exposed to groundwater in these EUs. However, groundwater within EU1 and EU19 is between 3 to 10 feet below ground surface and the depth of future intrusive activities is unknown; therefore, there is the potential that contact with groundwater could occur within these EUs. The groundwater in the floodplain area is also shallower than 15 feet, so there is a potential that the construction/utility worker in this area maybe exposed to groundwater during ground intrusive activities.

2.2.2.7 Maintenance/Outdoor Worker

The maintenance/outdoor worker would be an adult mowing the lawn or other outdoor activities in the Great Miami River floodplain area. These maintenance/outdoor workers would be conducting work activities at the ground surface and therefore no exposure to groundwater is expected to occur. During the lawn mowing/outdoor activities, dermal contact (through exposed skin on the head, hands, and forearms), incidental ingestion, and inhalation of airborne particulates and volatiles could occur as contact is made with surface soil of the floodplain area.

2.2.3 Data Summary

The following RI data that has been considered in the RAAD are summarized by the following:

OU1 Soil/fill:

- Analytical results for soil/fill samples collected within each individual EU were used as reported in the SCTM report for soil/fill and soil gas. Each EU was assessed individually based on the results for samples collected within the respective EU, with the exception of dioxin/furans. Due

to the limited number of sample results for dioxin/furans a site-wide assessment was conducted and then applied uniformly to each EU.

- Surface soil/fill sample results were used to assess risk for all EUs, including any sample that was collected, in whole or in part, from ground surface to 2 feet deep. Note that there were no exclusions due to the presence of existing cover, e.g., paved or gravel road surfaces.
- Soil/fill sample results to a maximum of 15 feet deep were used to assess risk for all EUs with exceptions discussed in Section 2.3.2.5.

Floodplain soil:

- Analytical results for surface soil samples collected adjacent to OU1 and background (upstream) floodplain soil samples collected in 2018 as reported in the SCTM report for soil/fill and soil gas.
- Analytical results for additional surface soil samples collected adjacent to OU1 in November 2019.
- Soil sample intervals include 0 to 0.5 feet and 0.5 to 2 feet deep.

Soil Gas:

- TO-15 results for soil gas probes installed by GHD and sampled in 2009, 2018, and 2019.
- TO-15 results for soil gas probes installed by USEPA and sampled in 2012.
- The soil gas analytical results were subdivided by area for purposes of this assessment including:
  - Dryden Road business parcels (GP12-09, GP13-09, GP14-09, GP15-09, GP16-09, GP20-09, GP20-18, GP22-13, GP23-13, GP24B-13, GP30-18, GP31-18, GP32-18, GP33-18, GP3-8, GP4-16, and GP6-12)
  - Valley Asphalt (GP01-18, GP19-18, GP01-09, GP17-09, GP18-09, and GP19-09)
  - Central area (GP02-09, GP03-09, GP04-09, GP05-09, GP21-09, GP25-18, GP26-18, GP27-18, GP28-18, GP29-18, and GP32-18)
  - South off-site (East River Road) area (GP1-8, GP06-09, and GP35-19)
  - Jim City parcels (GP07-09, GP08-09, GP07-18, GP08-19)
  - Barnett parcels (GP09-09, GP10-09)
  - Globe Equipment (GP11-09, and GP34-18)

Indoor Air:

- TO-15 results for air samples collected by GHD in 2019 (i.e., residential trailer crawl space and ambient air from EU5).

Groundwater:

- Analytical results for OU1 groundwater samples (upper and lower aquifer units) collected from 2013 to 2018 were used for the hypothetical potable scenario.
- Analytical results for OU1 groundwater samples (upper aquifer unit) collected from 2013 to 2018 were used for the groundwater to indoor air scenario.

- Analytical results OU1 groundwater samples (upper aquifer unit) where the groundwater table was less than 15 feet deep from 2013 to 2018, with the exception of two locations (VAS-11 and VAS-19) where 2008 groundwater data was used for the construction/utility worker direct contact exposure during ground intrusive activities.

Quarry Pond:

- Analytical results for surface water and sediment samples collected by GHD in 2018 as reported in April 2019.
- Analytical results for surface water and sediment samples collected by GHD in October 2019.

The COPCs identified in each media is discussed in the following section.

2.2.4 Selection of Chemicals of Potential Concern (COPCs)

This section presents the process for establishing the COPCs for the various media summarized above and that will be carried forward in to the HHRA. COPCs are chemicals that pose the greatest potential public health risk. In general, detected chemicals are identified as COPCs based upon their concentrations and known toxicity characteristics. The selection of COPCs considers analytical data reported for the Site and Quarry Pond (as summarized in Section 2.2.3).

For each chemical reported in each medium on site, comparisons were made to toxicity-based screening levels consisting of USEPA Regional Screening Levels (RSL) (USEPA, 2019a). The toxicity-based screening levels are non-site specific risk-based concentrations in environmental media (soil, air, and water) that are considered to be protective of humans, including sensitive groups, over a lifetime. Soil and groundwater RSLs are based on a target cancer risk of 1×10^{-6} and a target hazard quotient (HQ) of 0.1. As there are no RSLs specific to sediment and surface water, the USEPA RSL Calculator was used to develop sediment and surface water values based on a recreational user exposure. For the inhalation of airborne vapors in indoor air originating from soil vapor and groundwater exposure pathways, comparisons were made to USEPA Resident Vapor Intrusion Screening Levels (VISLs) (USEPA, 2019b). The specific toxicity-based screening levels that are used for COPC selection are listed below.

Medium	Screening Level
Surface and Subsurface Soil/fill	USEPA RSL residential soil
Soil Vapor/Groundwater to Indoor Air	USEPA VISL residential
Groundwater	USEPA RSL tapwater
Quarry Pond Sediment	USEPA RSL recreational sediment
Quarry Pond Surface Water	USEPA RSL recreational surface water
Indoor Air	USEPA RSL residential air

Residential screening values were conservatively used to identify the COPCs due to the residential use of EU5 to EU8 and the potential future residential use of the Site.

COPC selection related to fish tissue consumption are based on USEPA water quality criteria for surface water, and bio-accumulative substances for sediment.

For groundwater, only the upper aquifer unit was considered for the vapor intrusion and direct contact by a construction worker during ground intrusive activities (less than 15 feet BGS); however,

the complete groundwater data set (both upper and lower aquifer units) were considered for a future hypothetical potable use scenario. All groundwater within OU1 was consider rather than a subset of data (e.g., core of the plume).

The chemical data for each medium were evaluated to identify chemicals at concentrations above the toxicity-based screening levels. The higher of the primary and duplicate sample results were used for screening. Data qualified as estimated (J value) were treated as detected concentrations at the estimated concentration reported by the laboratory. All chemicals determined to be present at concentrations above these toxicity-based screening levels were identified as COPCs. All essential nutrients (e.g., calcium, magnesium, potassium, and sodium) and parameters reported as not detected and at concentrations below the screening criteria were not identified as COPCs and therefore not given further evaluation. Parameters that were not detected in any samples were not retained as COPCs. However, a comparison of the detection limits to the screening values has not been undertaken as yet. A discussion of exceedance of the screening levels based on the detection limits will be presented in the uncertainty section of the HHRA.

Those analytes without an applicable screening value due to a lack of toxicity information have been identified as COPCs and an appropriate and conservative surrogate analyte has been identified based on structural and toxicological similarity for evaluation within the HHRA.

Surrogate screening criteria were used for parameters without RSL screening value as follows:

Parameter	Surrogate Screening Value
1,3-dichlorobenzene	1,2-dichlorobenzene
methyl cyclohexane	Cyclohexane
3&4-methylphenol	3-methylphenol
Acenaphthylene	Acenaphthene
benzo(g,h,i)perylene	Pyrene
Phenanthrene	Pyrene
Dimethylphthalate	Diethylphthalate

Surrogate chemicals were identified based on their similarity in molecular structure and thus assumed toxicity. Pyrene was used as a surrogate for benzo(g,h,i)perylene and phenanthrene given that these analytes are non-carcinogenic polycyclic aromatic hydrocarbons (PAHs). 1,2-Dichlorobenzene, cyclohexane, 3-methylphenol, acenaphthene, and diethylphthalate were used as surrogates for 1,3-dichlorobenzene, methyl cyclohexane, 3&4-methylphenol, acenaphthylene, and dimethylphthalate respectively, due to their similarities in molecular structure.

Analytes that were detected and did not have an applicable screening value due to a lack of toxicity information or a suitable surrogate were not identified as COPCs.

Asbestos was analyzed in several of the EUs and identified as COPCs as there was no screening value, however, asbestos will not be carried forward into the HHRA. This parameter will be qualitatively discussed in the uncertainty section of the HHRA.

Selection of COPCs is presented in RAGS Part D Section 2 Table format. The COPCs identified for each of the impacted media by exposure area is discussed as follows OU1 soil (Section 2.2.4.1), OU1 soil vapor (Section 2.2.4.2), Outside of OU1 soil vapor (Section 2.2.4.3) OU1 indoor air

(Section 2.2.4.4), OU1 groundwater (Section 2.2.4.5), Quarry Pond (Section 2.2.4.6), and Floodplain (Section 2.2.4.7).

2.2.4.1 OU1 Soil/Fill

The following subsection provide the parameters that were identified in surface soil/fill (0 to 2 feet BGS) and soil/fill (0 to 15 feet BGS) for each EU.

2.2.4.1.1 EU 1

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.1 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Arsenic		
Benzo(b)fluoranthene	Chromium VI		
Carbazole	Cobalt		
Dibenz(a,h)anthracene	Iron		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Manganese		
	Thallium		

As per Section 5.2[3] of the RI/FS work plan, exposure to subsurface soil/fill to depths of 15 feet BGS in EU1 will not be considered as part of the HHRA due to the low potential for future development.

2.2.4.1.2 EU2

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.2 of Appendix A):

Metals	Dioxin/Furan
Aluminum	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Arsenic	
Cobalt	
Iron	
Manganese	
Thallium	

[3] See Section 5.2 of RI/FS work plan, page 65

Metals	Dioxin/Furan
Vanadium	Total TEQ assuming half the detection limit value for non-detects (ND=0.5)

As per Section 5.2 of the RI/FS work plan, exposure to subsurface soil/fill to depths of 15 feet BGS in EU2 will not be considered as part of the HHRA due to the low potential for future development.

2.2.4.1.3 EU3

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.3 of Appendix A):

SVOCs	Metals	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Arsenic	
Benzo(b)fluoranthene	Chromium VI	
Benzo(k)fluoranthene	Cobalt	
Carbazole	Iron	Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
Chrysene	Lead	
Dibenz(a,h)anthracene	Manganese	
Dibenzofuran	Thallium	
Flouroanthene	Vanadium	
Indeno(1,2,3-cd)pyrene		
Naphthalene		
Phenanthrene		
Pyrene		

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.4 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Aroclor-1242 (PCB-1242)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Antimony	Aroclor-1254 (PCB-1254)	
Benzo(b)fluoranthene	Arsenic		
Benzo(k)fluoranthene	Cadmium		
Carbazole	Chromium VI		

SVOCs	Metals	PCBs	Dioxin/Furan
Chrysene	Cobalt		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
Dibenz(a,h)anthracene	Iron		
Dibenzofuran	Lead		
Flouroanthene	Manganese		
Indeno(1,2,3-cd)pyrene	Thallium		
Naphthalene	Vanadium		
Phenanthrene			
Pyrene			

2.2.4.1.4 EU4

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.5 of Appendix A):

SVOCs	Metals	Dioxin/Furan
Benzo(a)pyrene	Aluminum	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(b)fluoranthene	Antimony	
Carbazole	Arsenic	
Dibenz(a,h)anthracene	Chromium VI	
	Cobalt	Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Iron	
	Manganese	
	Thallium	
	Vanadium	

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.6 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Antimony		
Benzo(b)fluoranthene	Arsenic		
Carbazole	Chromium VI		

SVOCs	Metals	PCBs	Dioxin/Furan
Dibenz(a,h)anthracene	Cobalt		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Iron		
	Manganese		
	Thallium		
	Vanadium		

2.2.4.1.5 EU3-Eu4

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.7 of Appendix A):

SVOCs	Metals	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Antimony	
Benzo(b)fluoranthene	Arsenic	
Benzo(k)fluoranthene	Chromium VI	
Carbazole	Cobalt	Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
Chrysene	Iron	
Dibenz(a,h)anthracene	Lead	
Dibenzofuran	Manganese	
Flouroanthene	Thallium	
Indeno(1,2,3-cd)pyrene	Vanadium	
Naphthalene		
Phenanthrene		
Pyrene		

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.8 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Aroclor-1242 (PCB-1242)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Antimony	Aroclor-1254 (PCB-1254)	
Benzo(b)fluoranthene	Arsenic		
Benzo(k)fluoranthene	Cadmium		
Carbazole	Chromium VI		

SVOCs	Metals	PCBs	Dioxin/Furan
Chrysene	Cobalt		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
Dibenz(a,h)anthracene	Iron		
Dibenzofuran	Lead		
Flouroanthene	Manganese		
Indeno(1,2,3-cd)pyrene	Thallium		
Naphthalene	Vanadium		
Phenanthrene			
Pyrene			

2.2.4.1.6 EU5-EU8

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.9 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Aroclor-1248 (PCB-1248)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Arsenic	Aroclor-1254 (PCB-1254)	
Benzo(b)fluoranthene	Chromium VI		
Carbazole	Cobalt		
Dibenz(a,h)anthracene	Copper		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Iron		
	Manganese		
	Nickel		
	Thallium		
	Vanadium		

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.10 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Aroclor-1248 (PCB-1248)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Antimony	Aroclor-1254 (PCB-1254)	

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(b)fluoranthene	Arsenic		
Carbazole	Chromium VI		
Dibenz(a,h)anthracene	Cobalt		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Copper		
	Iron		
	Manganese		
	Nickel		
	Thallium		
	Vanadium		

2.2.4.1.7 EU9

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.11 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Arsenic	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
	Benzo(a)pyrene	Chromium VI		
	Benzo(b)fluoranthene	Cobalt		
	Carbazole	Copper		
	Dibenz(a,h)anthracene	Iron		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Indeno(1,2,3-cd)pyrene	Manganese		
		Thallium		
		Vanadium		

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.12 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Aluminum	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for
	Benzo(a)pyrene	Arsenic		
	Benzo(b)fluoranthene	Chromium VI		

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
	Carbazole	Cobalt		non-detects (ND=0)
	Dibenz(a,h)anthracene	Copper		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Indeno(1,2,3-cd)pyrene	Cyanide (total)		
		Iron		
		Lead		
		Manganese		
		Thallium		
		Vanadium		

2.2.4.1.8 EU10

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.13 of Appendix A):

SVOCs	Metals	PCBs	Pesticides	Dioxin/Furan
Benzo(a)pyrene	Aluminum	Aroclor-1254 (PCB-1254)	Dieldrin	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(b)fluoranthene	Arsenic			
Carbazole	Chromium VI			
Dibenz(a,h)anthracene	Cobalt			
	Iron			Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Manganese			
	Thallium			

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.14 of Appendix A):

SVOCs	Metals	PCBs	Pesticides	Dioxin/Furan
Benzo(a)pyrene	Aluminum	Aroclor-1254 (PCB-1254)	Dieldrin	Total Toxic Equivalents (TEQ) assuming a zero
Benzo(b)fluoranthene	Arsenic			
Carbazole	Chromium VI			

SVOCs	Metals	PCBs	Pesticides	Dioxin/Furan
Dibenz(a,h)anthracene	Cobalt			value for non-detects (ND=0)
	Cyanide (total)			Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Iron			
	Manganese			
	Thallium			

2.2.4.1.9 EU11

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.15 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Arsenic		
Benzo(b)fluoranthene	Chromium VI		
Carbazole	Cobalt		
Dibenz(a,h)anthracene	Iron		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Manganese		
	Thallium		

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.16 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
Trichloroethene	Benzo(a)anthracene	Aluminum	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
	Benzo(a)pyrene	Arsenic		
	Benzo(b)fluoranthene	Cadmium		
	Carbazole	Chromium VI		
	Dibenz(a,h)anthracene	Cobalt		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
		Copper		
		Iron		
		Manganese		

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
		Thallium		
		Vanadium		

2.2.4.1.10 EU12

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.17 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)pyrene	Aluminum	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Carbazole	Arsenic		
Dibenz(a,h)anthracene	Cobalt		
	Iron		
	Manganese		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Thallium		
	Vanadium		

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.18 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)pyrene	Aluminum	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Carbazole	Arsenic		
Dibenz(a,h)anthracene	Chromium VI		
	Cobalt		
	Iron		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Manganese		
	Thallium		
	Vanadium		

2.2.4.1.11 EU13

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.19 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Pesticides	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Aluminum	Aroclor-1254 (PCB-1254)	Hepatchlor epoxide	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Trichloroethene	Benzo(a)pyrene	Antimony			
	Benzo(b)fluoranthene	Arsenic			
	Carbazole	Barium			
	Dibenz(a,h)anthracene	Cadmium			Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Indeno(1,2,3-cd)pyrene	Chromium VI			
	Naphthalene	Cobalt			
		Copper			
		Cyanide (total)			
		Iron			
		Lead			
		Manganese			
		Mercury			
		Nickel			
		Thallium			
		Vanadium			
		Zinc			

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.20 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Pesticides	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Aluminum	Aroclor-1242 (PCB-1242)	Hepatchlor epoxide	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Ethylbenzene	Benzo(a)pyrene	Antimony	Aroclor-1254 (PCB-1254)		
Trichloroethene	Benzo(b)fluoranthene	Arsenic			
Xylenes (total)	Carbazole	Barium			
	Dibenz(a,h)anthracene	Cadmium			Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Indeno(1,2,3-cd)pyrene	Chromium VI			
	Naphthalene	Cobalt			

VOCs	SVOCs	Metals	PCBs	Pesticides	Dioxin/Furan
		Copper			
		Cyanide (total)			
		Iron			
		Lead			
		Manganese			
		Mercury			
		Nickel			
		Thallium			
		Vanadium			
		Zinc			

2.2.4.1.12 EU14

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.21 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Aluminum	Aroclor-1242 (PCB-1242)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Trichloroethene	Benzo(a)pyrene	Antimony	Aroclor-1254 (PCB-1254)	
Vinyl chloride	Benzo(b)fluoranthene	Arsenic	Aroclor-1260 (PCB-1260)	
	Carbazole	Barium		
	Dibenz(a,h)anthracene	Cadmium		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Indeno(1,2,3-cd)pyrene	Chromium VI		
		Cobalt		
		Copper		
		Cyanide (total)		
		Iron		
		Lead		
		Manganese		
		Thallium		
		Vanadium		
		Zinc		

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.22 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Pesticides	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Aluminum	Aroclor-1242 (PCB-1242)	Dieldrin	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Ethylbenzene	Benzo(a)pyrene	Antimony	Aroclor-1248 (PCB-1248)		
Trichloroethene	Benzo(b)fluoranthene	Arsenic	Aroclor-1254 (PCB-1254)		
Vinyl Chloride	Carbazole	Barium	Aroclor-1260 (PCB-1260)		
	Dibenz(a,h)anthracene	Cadmium			Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Indeno(1,2,3-cd)pyrene	Chromium VI			
		Cobalt			
		Copper			
		Cyanide (total)			
		Iron			
		Lead			
		Manganese			
		Mercury			
		Nickel			
		Thallium			
		Vanadium			
		Zinc			

2.2.4.1.13 EU15

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.23 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Aluminum	Aroclor-1232 (PCB-1232)	Total Toxic Equivalents (TEQ) assuming a zero value for
Trichloroethene	Benzo(a)pyrene	Antimony	Aroclor-1242 (PCB-1242)	

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
	Benzo(b)fluoranthene	Arsenic	Aroclor-1248 (PCB-1248)	non-detects (ND=0)
	Carbazole	Barium	Aroclor-1254 (PCB-1254)	
	Dibenz(a,h)anthracene	Cadmium	Aroclor-1260 (PCB-1260)	Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Indeno(1,2,3-cd)pyrene	Chromium VI		
		Cobalt		
		Copper		
		Cyanide (total)		
		Iron		
		Lead		
		Manganese		
		Mercury		
		Thallium		
		Vanadium		
		Zinc		

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.24 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Aluminum	Aroclor-1232 (PCB-1232)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Ethylbenzene	Benzo(a)pyrene	Antimony	Aroclor-1242 (PCB-1242)	
Trichloroethene	Benzo(b)fluoranthene	Arsenic	Aroclor-1248 (PCB-1248)	
Xylenes (total)	Carbazole	Barium	Aroclor-1254 (PCB-1254)	
	Dibenz(a,h)anthracene	Cadmium	Aroclor-1260 (PCB-1260)	Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Indeno(1,2,3-cd)pyrene	Chromium VI		
		Cobalt		
		Copper		
		Cyanide (total)		
		Iron		
		Lead		

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
		Manganese		
		Mercury		
		Thallium		
		Vanadium		
		Zinc		

2.2.4.1.14 EU16

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.25 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
Vinyl chloride	Benzo(a)pyrene	Arsenic	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
	Benzo(b)fluoranthene	Chromium VI		
		Cobalt		
		Iron		
		Manganese		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
		Thallium		

Soil (0 to 15 feet BGS)

The soil (surface and subsurface) data consist of all soils less than or equal to 2 feet BGS to a depth of 15 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident, industrial/commercial worker, and construction/utility worker scenarios (as also shown in Table 2.26 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Pesticides	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Aluminum	Aroclor-1242 (PCB-1242)	Dieldrin	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Chlorobenzene	Benzo(a)pyrene	Antimony	Aroclor-1254 (PCB-1254)		
Ethylbenzene	Benzo(b)fluoranthene	Arsenic			
Tetrachloroethene	Indeno(1,2,3-cd)pyrene	Barium			

VOCs	SVOCs	Metals	PCBs	Pesticides	Dioxin/Furan
Trichloroethene	Naphthalene	Cadmium			Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
Vinyl chloride		Chromium VI			
Xylenes (total)		Cobalt			
		Copper			
		Cyanide (total)			
		Iron			
		Lead			
		Manganese			
		Mercury			
		Nickel			
		Thallium			
		Vanadium			
		Zinc			

2.2.4.1.15 EU17

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.27 of Appendix A):

SVOCs	Metals	PCBs	Dioxin/Furan
Benzo(a)anthracene	Aluminum	Aroclor-1254 (PCB-1254)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
Benzo(a)pyrene	Antimony		
Benzo(b)fluoranthene	Arsenic		
Carbazole	Barium		
Dibenz(a,h)anthracene	Cadmium		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Chromium VI		
	Cobalt		
	Copper		
	Cyanide (total)		
	Iron		
	Lead		
	Manganese		
	Nickel		
	Thallium		
	Vanadium		
	Zinc		

As per Section 5.2 of the RI/FS work plan, exposure to subsurface soil/fill to depths of 15 feet BGS in EU17 will not be considered as part of the HHRA due to the low potential for future development.

2.2.4.1.16 EU18 –EU19

Surface Soil (0 to 2 feet BGS)

The surface soil data consist of all soils less than or equal to 2 feet BGS.

The following parameters were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.28 of Appendix A):

VOCs	SVOCs	Metals	PCBs	Dioxin/Furan
1,1-Dichloroethane	Benzo(a)anthracene	Aluminum	Aroclor-1242 (PCB-1242)	Total Toxic Equivalents (TEQ) assuming a zero value for non-detects (ND=0)
	Benzo(a)pyrene	Antimony	Aroclor-1248 (PCB-1248)	
	Benzo(b)fluoranthene	Arsenic	Aroclor-1254 (PCB-1254)	
	Carbazole	Cadmium	Aroclor-1260 (PCB-1260)	
	Dibenz(a,h)anthracene	Chromium VI		Total TEQ assuming half the detection limit value for non-detects (ND=0.5)
	Indeno(1,2,3-cd)pyrene	Cobalt		
		Copper		
		Cyanide (total)		
		Iron		
		Lead		
		Manganese		
		Nickel		
		Thallium		
		Vanadium		
		Zinc		

As per Section 5.2 of the RI/FS work plan, exposure to subsurface soil/fill to depths of 15 feet BGS in EU18-EU19 will not be considered as part of the HHRA due to the low potential for future development.

2.2.4.2 OU1 Soil Vapor

EU3-EU4 Soil Vapor

The following volatile organic compounds (VOCs) were detected in soil gas samples at maximum concentrations greater than the residential screening values, and therefore were identified as

COPCs for the resident and industrial/commercial worker scenarios (as also shown in Table 2.29 of Appendix A):

VOCs
1,2,4-Trimethylbenzene
Benzene
Cyclohexane
Ethylbenzene
Hexane
Isopropyl benzene (Cumene)
N-Heptane
Toluene
Xylenes (total)

EU5-EU8 Soil Vapor

The following VOCs were detected in soil gas samples at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident and industrial/commercial worker scenarios (as also shown in Table 2.30 of Appendix A):

VOCs
Trichloroethene

EU9-EU15 Soil Vapor

The following VOCs were detected in soil gas samples at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident and industrial/commercial worker scenarios (as also shown in Table 2.31 of Appendix A):

VOCs
1,1-Dichloroethane
Carbon tetrachloride
Chloroform (Trichloromethane)
Tetrachloroethene
Trichloroethene
Vinyl chloride

EU16 Soil Vapor

The following VOCs were detected in soil gas samples at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident and industrial/commercial worker scenarios (as also shown in Table 2.32 of Appendix A):

VOCs
1,1-Dichloroethane
Benzene
Chlorobenzene
Cyclohexane

VOCs
Ethylbenzene
Isopropyl benzene (Cumene)
Naphthalene
N-Heptane
Trichloroethene
Vinyl chloride
Xylenes (total)

EU18-EU19 Soil Vapor

The following VOCs were detected in soil gas samples at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident and industrial/commercial worker scenarios (as also shown in Table 2.33 of Appendix A):

VOCs
1,4-Dichlorobenzene
Benzene
Chlorobenzene
Chloroform (Trichloromethane)
Dichlorodifluoromethane (CFC-12)
Ethylbenzene
Hexane
N-Heptane
Tetrachloroethene
Trichloroethene
Vinyl chloride
Xylenes (total)

2.2.4.3 Outside of OU1 Soil Vapor

Outside of OU1 (South – East River Road)

The following VOCs were detected in soil gas samples at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident and industrial/commercial worker scenarios (as also shown in Table 2.34 of Appendix A):

VOCs
Bromodichloromethane
Chloroform (Trichloromethane)

Outside of OU1 (Globe)

As presented in Table 2.35 of Appendix A, none of the detected maximum concentrations within this area (Globe) were greater than the residential screening values, and therefore no COPCs were identified for this area.

2.2.4.4 OU1 Indoor Air

EU5-EU8 Indoor Air (crawl space under trailer in EU5)

The following VOCs were detected at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident scenario (as also shown in Table 2.36 of Appendix A):

VOCs
1,4-Dioxane
Benzene
Carbon tetrachloride

2.2.4.5 OU1 Groundwater

Groundwater – Upper and Lower Aquifers – Hypothetical Potable Exposure

The following parameters were detected in OU1 groundwater samples at maximum concentrations greater than the tap water screening values, and therefore were identified as COPCs for the resident scenario (as also shown in Table 2.37 of Appendix A):

VOCs	SVOCs	Metals
1,1-Dichloroethane	Biphenyl	Aluminum
1,2,4-Trichlorobenzene	bis(2-Ethylhexyl)phthalate	Antimony
1,2-Dibromo-3-chloropropane	Naphthalene	Arsenic
1,2-Dichloroethane		Barium
1,4-Dichlorobenzene		Beryllium
Benzene		Cadmium
Bromodichloromethane		Chromium
Chlorobenzene		Cobalt
Chloroform		Copper
cis-1,2-Dichloroethene		Cyanide (total)
Ethylbenzene		Iron
Methylene chloride		Lead
Toluene		Manganese
Trichloroethene		Mercury
Vinyl chloride		Nickel
Xylenes (total)		Selenium
		Thallium
		Vanadium
		Zinc

Groundwater to Indoor Air - Upper Aquifer

The following parameters were detected in OU1 groundwater samples at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the resident and industrial/commercial worker scenarios (as also shown in Table 2.38 of Appendix A):

VOCs	SVOCs	Metals
1,1-Dichloroethane	Naphthalene	Cyanide (total)
1,4-Dichlorobenzene		Mercury
Benzene		
Chloroform		
Ethylbenzene		
Trichloroethene		
Vinyl chloride		
Xylenes (total)		

Groundwater – OU1 Upper Aquifer (EU1 & EU19)

The following parameters were detected in groundwater samples at maximum concentrations greater than the tap water screening values, and therefore were identified as COPCs for the construction/utility worker scenario (as also shown in Table 2.40 of Appendix A):

VOCs	SVOCs	Metals
1,1-Dichloroethane	bis(2-Ethylhexyl)phthalate (DEHP)	Aluminum
Benzene	Naphthalene	Antimony
Bromodichloromethane		Arsenic
Chlorobenzene		Barium
Chloroform		Cadmium
Ethylbenzene		Chromium
Trichloroethene		Cobalt
Vinyl chloride		Copper
		Iron
		Lead
		Manganese
		Nickel
		Thallium
		Vanadium
		Zinc

Groundwater is located at depths greater than 15 feet BGS in the majority of the EUs, therefore the construction/utility worker will not be exposed to groundwater in these EUs. However, groundwater within EUs 1 and 19 is between 3 to 10 feet BGS and the depth of future intrusive activities is unknown; therefore, there is the potential that contact with groundwater could occur within these EUs. The groundwater data set considered here was only based on the upper aquifer groundwater data that was located at a depth less than 15 feet BGS.

2.2.4.6 Quarry Pond

Quarry Pond Sediment – Direct Contact

The following parameters were detected in sediment samples at maximum concentrations greater than the recreational user screening values in the complete sediment dataset that included all depths below the surface water, and therefore were identified as COPCs for the trespasser and construction/utility worker scenarios (as also shown in Table 2.41 of Appendix A):

SVOCs	Metals
Benzo(a)anthracene	Arsenic
Benzo(a)pyrene	Chromium
Benzo(b)fluoranthene	Thallium
Carbazole	
Dibenz(a,h)anthracene	
Indeno(1,2,3-cd)pyrene	

Given that majority of these samples are located at depth below the surface water, a reduced subset was considered for direct contact by the trespasser and construction/utility worker scenarios. The sediments that were located 10 feet or less below the surface water considered to be the appropriate data set for direct contact. The COPCs identified in this data set are presented below.

Quarry Pond Sediment (Shallow) – Direct Contact

The following parameters were detected in sediment samples at maximum concentrations greater than the recreational user screening values, and therefore were identified as COPCs for the trespasser and construction/utility worker scenarios (as also shown in Table 2.42 of Appendix A):

Metals
Arsenic
Chromium

Quarry Pond Sediment Bioaccumulation to Fish

The following parameters were detected in sediment samples and considered bioaccumulative according to USEPA (2000), and therefore were identified as COPCs for the fish eater scenario (as also shown in Table 2.43 of Appendix A):

SVOCs	Metals	PCBs	Pesticides
Acenaphthene	Arsenic	Aroclor-1242 (PCB-1242)	alpha-Chlordane
Acenaphthylene	Cadmium	Aroclor-1254 (PCB-1254)	gamma-Chlordane
Anthracene	Chromium		
Benzo(a)anthracene	Copper		
Benzo(a)pyrene	Lead		
Benzo(b)fluoranthene	Mercury		
Benzo(g,h,i)perylene	Methyl mercury		
Benzo(k)fluoranthene	Nickel		

SVOCs	Metals	PCBs	Pesticides
Chrysene	Selenium		
Dibenz(a,h)anthracene	Silver		
Fluoranthene	Zinc		
Fluorene			
Indeno(1,2,3-cd)pyrene			
Phenanthrene			
Pyrene			

Quarry Pond Surface Water – Direct Contact

The following parameters were detected in surface water samples at maximum concentrations greater than the recreational screening values, and therefore were identified as COPCs for the trespasser and construction/utility worker scenarios (as also shown in Table 2.44 of Appendix A):

Metals
Arsenic
Manganese
Thallium

Quarry Pond Surface Water Bioaccumulation to Fish

The following parameters were detected in surface water samples at maximum concentrations greater than the USEPA water quality criteria, and therefore were identified as COPCs for the fish eater scenario (as also shown in Table 2.45 of Appendix A):

VOCs	SVOCs	Metals	PCBs
1,2,4-Trichlorobenzene	Butylbenzyl phthalate	Arsenic	Aroclor-1254 (PCB-1254)
		Manganese	
		Mercury	
		Thallium	

Three organic parameters (1,2,4-trichlorobenzene, butyl benzlphthalate, and Aroclor-1254) were detected as estimated values in 2018 surface water samples. However, these compounds were not detected in 2019 samples from the 32 surface water samples collected within the Quarry Pond. Given the low frequency of detection of these three parameters and since they have not been identified in the 2019 sampling event, these parameters are not considered as COPCs for the consumption of the organisms based on surface water quality in the Quarry Pond.

The screening level for manganese is based on organoleptic (taste and odor) effects and not based on ingestion of organisms in the surface water. Manganese was detected at concentrations above the screening levels at only three sample locations, and all other surface water concentrations were well below the screening level. GHD notes that the elevated concentrations of manganese occur only at depth within the Quarry Pond, due to sub-oxic conditions. Because fish avoid water with low dissolved oxygen, they would not come into contact with these high manganese concentrations. Therefore, manganese is not expected to be a concern for ingestion of fish. However, manganese

has been conservatively carried forward as a surface water COPC for the consumption of organisms.

As a result, arsenic, manganese, and thallium are considered to be COPCs for the consumption of the organisms related to surface water conditions.

2.2.4.7 Floodplain

Background Floodplain Surface Soil (0-2 feet BGS)

The following parameters were detected in floodplain soil samples at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.46 of Appendix A):

SVOCs	Metals	PCBs
Benzo(a)pyrene	Aluminum	Aroclor-1254 (PCB-1254)
Carbazole	Arsenic	
	Chromium VI	
	Cobalt	
	Iron	
	Manganese	
	Thallium	

Floodplain Surface Soil (0-2 feet BGS)

The following parameters were detected in floodplain soil samples at maximum concentrations greater than the residential screening values, and therefore were identified as COPCs for the trespasser, resident, and industrial/commercial worker scenarios (as also shown in Table 2.47 of Appendix A):

SVOCs	Metals	PCBs
Benzo(a)anthracene	Aluminum	Aroclor-1248 (PCB-1248)
Benzo(a)pyrene	Arsenic	Aroclor-1254 (PCB-1254)
Benzo(b)fluoranthene	Chromium VI	
Carbazole	Cobalt	
Dibenz(a,h)anthracene	Iron	
	Manganese	
	Thallium	

Groundwater - Floodplain

The following parameters were detected in groundwater samples at maximum concentrations greater than the tap water screening values, and therefore were identified as COPCs for the construction/utility worker scenario (as also shown in Table 2.39 of Appendix A):

VOCs	SVOCs	Metals	PCBs
Chloroform	Benzo(a)anthracene	Aluminum	Aroclor-1248 (PCB-1248)
Trichloroethene	Benzo(a)pyrene	Antimony	Aroclor-1260 (PCB-1260)

VOCs	SVOCs	Metals	PCBs
	Benzo(b)fluoranthene	Arsenic	
	Indeno(1,2,3-cd)pyrene	Barium	
		Beryllium	
		Cadmium	
		Chromium	
		Cobalt	
		Copper	
		Iron	
		Lead	
		Manganese	
		Mercury	
		Nickel	
		Selenium	
		Thallium	
		Vanadium	
		Zinc	

2.2.4.8 Summary of COPC Selection

Based on the conservative screening criteria (ingestion, dermal, and inhalation exposure pathways), COPCs have been identified in surface soil, soil (surface and subsurface), soil vapor, groundwater, sediment, and surface water on site. From this COPC selection process, the following media in each area unit have been identified:

Area	Media with COPCs
EU1	surface soil, groundwater
EU2	surface soil, groundwater
EU3	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU4	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU3-EU4	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU5-EU8	surface soil, soil (surface and subsurface), soil vapor, groundwater, indoor air (crawl space)
EU9	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU10	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU11	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU12	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU13	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU14	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU15	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU16	surface soil, soil (surface and subsurface), soil vapor, groundwater
EU17	surface soil, groundwater

Area	Media with COPCs
EU18-EU19	surface soil, soil vapor, groundwater
Floodplain	surface soil, groundwater
Outside of OU1 (South)	soil vapor
Quarry Pond	sediment, fish (via sediment and surface water), surface water

2.3 Exposure Assessment

Exposure is defined as the contact of a receptor (i.e., person) with a chemical or physical agent. The exposure assessment is the estimation of the magnitude, frequency, duration, and routes of exposure. An exposure assessment provides a systematic analysis of the potential exposure mechanism by which a receptor may be exposed to chemical or physical agents at or originating from a study area. The objectives of an exposure assessment are as follows:

- Characterization of exposure setting (see Section 2.3.1)
- Identification of potential exposure pathways (see Section 2.3.2)
- Quantification of exposure (see Section 2.3.3)

Special considerations related to evaluation of exposures to lead in the various media are discussed in Section 2.3.4 (non-residential) and Section 2.3.5 (residential).

2.3.1 Characterization of Exposure Setting

As part of the HHRA process, potential exposure pathways are determined through an evaluation of the physical setting of the site and the potentially exposed populations. The consideration of site-specific factors related to land usage is important in the development of realistic current and future exposure scenarios and quantification of risks and hazards. The current and future potential land uses that are reasonably expected for the site determine what populations may potentially be exposed. The site land uses discussed in the following subsections were selected consistent with the methodology presented in the USEPA (1995) memorandum for the development of the current land use and reasonably anticipated future land uses.

2.3.1.1 Current Land Use

The area of the Site generally includes a combination of developed and undeveloped land. The northern and central areas include a variety of operating commercial businesses with access along Dryden Road, and open ground within the central area situated between the operating businesses and the MCD floodway. The southern area includes operating businesses with access along East River Road, and the Quarry Pond situated adjacent to the MCD floodway.

The types of operating businesses include asphalt production (Valley Asphalt), truck repair, auto salvage, commercial, and construction as previously presented in Section 1.3.

There is a fence around the majority of the central 25 acres (Parcel 5177) while separate fencing encompasses most of the northern and southern parcels that are within the OU1 boundary. The south and western portions of the Quarry Pond are not fenced and there is not a fence between Valley Asphalt and the MCD floodway/recreational trail.

Therefore, the Site is located in an area of mixed urban, commercial, industrial, and residential development. The current zoning for the off-site area affected by past site operations is commercial/residential. The nearest residential property is located adjacent the southeast boundary of the Site.

The current potentially exposed population includes persons who may infrequently trespass on the Site, commercial/industrial workers in the various EUs, and residents and commercial/industrial workers off site.

Due to the presence of fish in the Quarry Pond, a trespasser may fish and take the fish home for consumption a fish eater has also been considered. A recreational user will also be considered due to the presence of the recreational trail along the GMR. A maintenance/outdoor worker that will cut grass along this recreational trail will also be considered.

2.3.1.2 Future Land Use

The future use of the Site is anticipated to be the same as the current land use. However, should the Site be redeveloped for residential use in the future, a resident and construction/utility worker will also be considered under this future redevelopment scenario. The future potentially exposed population for the Site includes trespassers, residents, commercial/industrial workers, construction/utility worker. As noted under the current land use, the presence of the Quarry Pond on Site and recreational trail along GMR, will require consideration of a fish eater due to fish in Quarry Pond and recreational user and maintenance/outdoor worker due to the recreational trail along the GMR.

2.3.2 Identification of Potential Exposure Pathways

An exposure pathway describes a mechanism by which humans may come into contact with site-related COPCs. An exposure pathway is complete (i.e., it could result in a receptor contacting a COPC) if all of the following four elements are present:

1. A source or a release from a source (e.g., COPCs released to soil during historical landfill operations [see Section 2.3.2.1]).
2. A probable environmental migration route of a site-related COPC (e.g., leaching or partitioning from one medium to another [see Section 2.3.2.2]).
3. An exposure point where a receptor may come in contact with a site-related COPC (e.g., surface and subsurface soil on and off site [see Section 2.3.2.3]).
4. A pathway by which a site-related COPC may enter a potential receptor's body (e.g., ingestion, dermal contact, or inhalation [see Section 2.3.2.4]).

If any of these four elements are not present, then the exposure pathway is considered incomplete and does not contribute to the total exposure from the site. Exposure scenarios and completed exposure pathways are discussed in Section 2.3.2.5.

2.3.2.1 Release Mechanisms

The potential mechanisms of contaminant release at the site are:

- Erosion of the cover material, exposing landfill contents so they are released by direct contact and/or wind
- Leaching of contaminants from landfill contents or contaminated soil to the soil and groundwater
- Release of contaminants from exposed landfill contents or contaminated surficial soil through contact with surface water
- Release of contaminants from the soil to ambient air by volatilization and wind
- Release of contaminants from the groundwater by volatilization through the unsaturated zone to ambient air or indoor air.

A discussion of the release mechanisms is presented below.

Site investigations have determined that the soil/fill areas are largely covered by a combination of vegetated soil, paved surfaces and roadways, buildings, and stockpiled industrial materials. As a result there is very little existence of exposed waste material and the potential for exposure via direct contact and wind transport is very limited.

Contaminant release and transport of COPCs to groundwater could occur as a result of leaching from soil/fill material. Downward transport of soluble materials to groundwater from soil/fill in infiltrating water could occur either by precipitation and/or leaching. In addition the fill material is partially below the water table, which fluctuates according to precipitation events and the effects of the Great Miami River water level. Periodically the river level rises within the floodway area encroaching onto the Site. Therefore surface water may accumulate on the Site and eventually recedes as the water level in the river declines. This contributes to potential leaching and possible contaminant migration through leaching or overland runoff toward the floodway. However much of this potential is mitigated due to the topography within the Site and the presence of the Quarry Pond.

VOCs in the soil/fill and/or the groundwater of the unconfined upper aquifer have the potential to be released to the unsaturated zone by diffusion. The VOCs theoretically could at that point migrate through the unsaturated zone to ambient and/or indoor air.

2.3.2.2 Fate and Transport in Receiving Media

Many complex factors control the partitioning of a chemical in the environment. An understanding of the general fate and transport characteristics of the COPCs are important when predicting future theoretical exposure, linking sources with currently contaminated media, and identifying potentially complete pathways to site media. Therefore, the fate and transport analysis conducted at this stage of the exposure assessment is meant to identify media that are likely to receive site-related COPCs. The potential contaminant transport mechanisms at the site are:

- Movement with wind
- Movement with surface water
- Movement during construction disturbance

- Movement with groundwater
- Movement of VOCs (from groundwater and soil) within soil gas

The exposure of wastes at the surface may result in the transport of dust and VOCs by wind. As previously stated, the soil/fill material at the Site is largely covered. The existing soil/fill likely does not restrict upward migration of soil gas except where impervious materials are present. The existing soil/fill has also been found to contain detectable concentrations of chemicals. The presence of chemicals within the existing soil/fill may contribute to chemical migration of VOCs or fugitive dust. VOCs in the air will be subject to dispersion by the wind and photolysis due to exposure to sunlight, thereby limiting their concentrations.

Construction activities may also result in disturbance of contaminants in the various media. Contaminants attached to soil/fill particulates may become suspended in the air column and transported by wind.

Movement with groundwater is a potential transport mechanism. The Upper Aquifer and Lower Aquifer groundwater contains VOCs and other chemicals in portions of OU1. Once the chemicals have entered the groundwater, the following migration pathways are possible.

1. Groundwater migration in the Upper and Lower Aquifer could occur to areas outside of the OU1 or to the Quarry Pond.
2. VOCs in the Upper Aquifer can migrate through the vadose zone via diffusion to ambient and/or indoor air.

During groundwater transport, the contaminants released to the groundwater will be subject to dispersion, adsorption, volatilization, and biotic and abiotic degradation.

2.3.2.3 Potential Exposure Points

After contaminated or potentially contaminated media have been identified, the exposure points are determined by identifying whether or not the potentially exposed population can contact these media.

The exposure domain is the area within which the potentially exposed population may contact the contaminated media. For example, ingestion of surface soil by a current trespasser is complete only in areas that are not covered. Therefore, the exposure domain for surface soil ingestion by a current trespasser would include only the areas not under a cover.

The indoor air pathway is to be evaluated for future conditions in all EUs and in the case for existing buildings in the EUs and Off Site area. For future buildings where vapor intrusion is potentially complete, this exposure pathway can be eliminated by implementing vapor intrusion barriers in the foundations irrespective of whether or not the proposed location has been evaluated for potential vapor intrusion.

2.3.2.4 Potential Exposure Routes

An exposure route is the fourth element of an exposure pathway. Exposure pathways are identified through: i) determining the COPC sources and receiving media, ii) analyzing the movement of the COPCs from the source, and iii) determining the possible exposure points.

In general, humans can be exposed to different environmental media, including soil, groundwater, sediment, surface water, air, and biota contacting the other contaminated media. Based on the physical conditions of the site, potential exposure routes associated with exposure to on-Site soil, soil gas, groundwater, sediment, and surface water may include incidental ingestion, direct dermal contact, and inhalation (airborne particulates and/or vapors).

There is no known use of groundwater for potable purposes in the vicinity of the Site. Locally, potable water is provided from the municipal supply system. Nevertheless, as a conservative measure, the hypothetical future potable groundwater exposure scenario by a future resident within the HHRA.

2.3.2.5 Exposure Scenarios and Completed Exposure Pathways

Based on an understanding of the four components of an exposure pathway and the current/future conditions of the site, human exposure pathways were identified that will be evaluated in the HHRA. The Site is a historical filled area that has been partially re-developed with commercial/industrial land use along Dryden Road. Portions of the Site remain undeveloped including the filled central area and the Quarry Pond. As a result, the potential human populations considered relevant to the HHRA for current and future site conditions include an adolescent trespasser, a resident (child and adult), a commercial/industrial worker, fish eater (child and adult), recreational user (child and adult), maintenance/outdoor worker, and a construction/utility worker who potentially may be involved in ground intrusive activities during general construction activities. Access to the Site is restricted by fencing around the majority of the central 25 acres (Parcel 5177) while separate fencing encompasses most of the northern and southern parcels that are within the OU1 boundary. The south and western portions of the Quarry Pond are not fenced and there is not a fence between Valley Asphalt and the MCD floodway/recreational trail. Therefore, it is unlikely that trespassers would actively frequent these areas of the Site. However, a hypothetical on-site trespasser exposure to site media (surface soil, ambient air) will be evaluated in the HHRA.

Based on the information presented above, the media and potential human exposures (i.e., complete pathways) that have been assessed quantitatively in the HHRA by exposure area are presented below. The exposure assumptions for each of the complete exposure pathways have been presented in RAGS Part D Table 4 format (see Appendix A). The HHRA CSM shown on Table 1 in Appendix A (also Figure 2.1) presents a summary of the exposure media, exposure pathways, exposure routes, and exposed receptors that will be considered in the HHRA. The following media and potential human exposures (i.e., complete pathways) have been identified for quantitative evaluation in the HHRA:

1. Surface Soil/fill – Current Condition within OU1:
    - Dermal contact with surface soil/fill by trespasser, resident within EU5 to EU8, and industrial/commercial worker.
    - Incidental ingestion of surface soil/fill by trespasser, resident within EU5 to EU8, and industrial/commercial worker.
2. Air – Current Condition within OU1:
    - Inhalation of particulate in outdoor air originating from surface soil/fill by trespasser, resident within EU5 to EU8, and industrial/commercial worker.

- Inhalation of vapors in outdoor air originating from soil and groundwater by resident within EU5 to EU8, and industrial/commercial worker.
- Inhalation of vapors in indoor air originating from soil vapor and groundwater by resident and industrial/commercial worker.

3. Soil/fill (surface and subsurface) - Future Condition within OU1:
   - Dermal contact with soil by resident, industrial/commercial worker, and construction/utility worker except as follows. The potential exposure of construction workers to subsurface soil/fill to depths of 15 feet BGS in EU1, EU2, EU17, EU18, and EU19 will not be considered as part of the HHRA due to the low potential for future development[4]; therefore, for these scenarios the surface soil data set will be used to evaluate the construction/utility worker exposure.
   - Incidental ingestion of soil by resident, industrial/commercial worker, and construction/utility worker.
4. Air – Future Condition within OU1:
   - Inhalation of particulate in outdoor air originating from soil (surface and subsurface) by resident, industrial/commercial worker, and construction/utility worker.
   - Inhalation of vapors in outdoor air originating from soil (surface and subsurface) and groundwater by resident, industrial/commercial worker, and construction/utility worker.
   - Inhalation of vapors in indoor air originating from soil vapor and groundwater by resident and industrial/commercial worker.
5. Groundwater – Future Condition within OU1:
   - Dermal contact with groundwater by resident and construction/utility worker.
   - Incidental ingestion of groundwater by construction/utility worker during ground intrusive activities.
   - Ingestion of the groundwater as a potable source by resident.
6. Quarry Pond – Current/Future Condition:
   - Ingestion of fish by fish eater (child and adult), fish tissue concentrations based on uptake from surface water and sediment.
7. Quarry Pond Surface Water – Current/Future Condition:
   - Dermal contact with surface water by trespasser (adolescent) and construction/utility worker.
   - Incidental ingestion of surface water by trespasser (adolescent) and construction/utility worker.
8. Quarry Pond Sediment – Current/Future Condition:
   - Dermal contact with sediment by trespasser (adolescent) and construction/utility worker.

[4] See Section 5.2 of RI/FS work plan, page 65

- Incidental ingestion of sediment by trespasser (adolescent) and construction/utility worker.

9. Surface Soil – Current/Future Condition within Floodplain:
    - Dermal contact with surface soil by recreational user, maintenance/outdoor worker, and construction/utility worker.
    - Incidental ingestion of surface soil by recreational user, maintenance/outdoor worker, and construction/utility worker.
10. Air – Current/Future Condition outside of OU1:
    - Inhalation of vapors in indoor air originating from soil vapor and groundwater by industrial/commercial worker.

Descriptions of each of these potential exposure scenarios are presented in Section 2.3.3.

2.3.3 Quantification of Exposure

An Exposure Point Concentration (EPC) is a conservative estimate of the contaminant concentration at an exposure point or in an exposure area. EPCs were calculated for each analyte selected as a COPC via the screening process described in Section 2.2.2. EPCs are calculated for those media and pathways for which quantitative risk assessment is to be conducted consistent with the CSM for each EU. These media include surface soil, soil (surface and subsurface), sediment, surface water, and soil vapor. The complete groundwater data set was considered when calculating the EPC rather than a subset of data. Groundwater datasets varied based on the exposure scenario. The groundwater datasets by exposure scenario are as follows:

- Potable groundwater scenario – all OU1 upper and lower aquifer
- Direct contact during intrusive activities – subset of upper aquifer that is less than 15 feet BGS (e.g., in EU1 and EU19)
- Vapor Intrusion – all OU1 upper aquifer

EPCs have been presented in RAGS Part D Table 3 format, which includes the maximum detected concentration, the arithmetic mean concentration, and the 95 percent upper confidence limit (UCL) of the mean, calculated using USEPA's ProUCL software Version 5.1 (2015). These tables present the Reasonable Maximum Exposure (RME) as well. The RME values have been conservatively based on the 95 percent UCL of the mean.

ProUCL 5.1 contains statistical methods to address data sets both with and without non-detects and computes the 95 percent UCL for a given data set by a variety of alternative statistical approaches (including several approaches that do not require the assumption of normality or log-normality). ProUCL 5.1 then recommends specific UCL values as being the most appropriate for that particular data set. For EPCs based on a 95 percent UCL, the distribution type and specific 95 percent UCL type selected by the ProUCL software have been indicated in the EPC table. Non-detect and duplicate results were handled as follows:

- The sample-specific method detection limit (MDL) (rather than the reporting limit [RL]) was considered for non-detect results in the calculation of 95 percent UCL values.
- Arithmetic mean calculations used the sample-specific MDL to account for non-detect results.

- Only data deemed usable based on the data validation process were included.
- Duplicate sample results were averaged to calculate EPCs[5].
- In cases where more than one 95 percent UCL is calculated by ProUCL, the greater of the two values was assigned as the EPC for that analyte. If the calculated 95 percent UCL is higher than the maximum concentration, then the maximum concentration has been used.

For data sets containing less than ten distinct detected values, the maximum detected concentration was used as the EPC. The ProUCL inputs and outputs are presented in Appendix B. The EPC summaries for the COPCs in each exposure area and media are presented in the following tables of Appendix A:

Medium	EPC Table Reference
EU1 Surface Soil	Table 3.1
EU2 Surface Soil	Table 3.2
EU3 Surface Soil	Table 3.3
EU3 Soil (surface and subsurface)	Table 3.4
EU4 Surface Soil	Table 3.5
EU4 Soil (surface and subsurface)	Table 3.6
EU3-EU4 Surface Soil	Table 3.7
EU3-EU4 Soil (surface and subsurface)	Table 3.8
EU5-EU8 Surface Soil	Table 3.9
EU-EU8 Soil (surface and subsurface)	Table 3.10
EU9 Surface Soil	Table 3.11
EU9 Soil (surface and subsurface)	Table 3.12
EU10 Surface Soil	Table 3.13
EU10 Soil (surface and subsurface)	Table 3.14
EU11 Surface Soil	Table 3.15
EU11 Soil (surface and subsurface)	Table 3.16
EU12 Surface Soil	Table 3.17
EU12 Soil (surface and subsurface)	Table 3.18
EU13 Surface Soil	Table 3.19
EU13 Soil (surface and subsurface)	Table 3.20
EU14 Surface Soil	Table 3.21
EU14 Soil (surface and subsurface)	Table 3.22
EU15 Surface Soil	Table 3.23
EU15 Soil (surface and subsurface)	Table 3.24
EU16 Surface Soil	Table 3.25
EU16 Soil (surface and subsurface)	Table 3.26
EU17 Surface Soil	Table 3.27
EU18-EU19 Surface Soil	Table 3.28

[5] The agency requested that the higher concentration of duplicate samples be used rather than averaging the results. The EPC currently presented in the EPC tables currently are based on an average of the duplicate samples. It is not anticipated that changing to the maximum concentration of the duplicate samples will change the EPC significantly, however, this revision will be undertaken and presented in the EPCs in the HHRA.

Medium	EPC Table Reference
EU3-EU4 Soil Vapor (Jim City)	Table 3.29
EU5-EU8 Soil Vapor (Barnett)	Table 3.30
EU9-EU15 Soil Vapor (Dryden Rd.)	Table 3.31
EU16 Soil Vapor (Valley Asphalt)	Table 3.32
EU18-EU19 Soil Vapor (Central)	Table 3.33
Outside of OU1 Soil Vapor (South)	Table 3.34
Indoor Air	Table 3.35
Groundwater – Upper and Lower Aquifers	Table 3.36
Groundwater to Indoor Air – Upper Aquifer	Table 3.37
Groundwater – Floodplain	Table 3.38
Groundwater – OU1 Upper Aquifer (EU1 & EU19)	Table 3.39
Sediment	Table 3.40
Sediment Bioaccumulation to Fish	Table 3.41
Surface Water	Table 3.42
Surface Water Bioaccumulation to Fish	Table 3.43
Background Floodplain Surface Soil	Table 3.44
Floodplain Surface Soil	Table 3.45

2.3.3.1 Exposure Variables

Estimation of the human intake received through the various exposure pathways is based upon Chronic Daily Intakes (CDIs) expressed in terms of the mass of substance taken into the body per unit body weight per unit time (mg/kg day) for ingestion and dermal exposures or Exposure Concentration (EC) expressed in terms of mass per volume (mg/m^3) for inhalation exposures. CDIs and ECs are calculated as a function of EPC, contact rate (for CDI only), exposure frequency and duration, body weight (for CDI only), and averaging time.

Given the range of different exposure conditions that may be encountered by exposed populations, USEPA (1995) recommends that exposure assessments include both the "high end" and "central tendency" portions of the risk distribution. The "high end" exposure is designated the RME, defined as the highest exposure that is reasonably expected to occur. The central tendency exposure (CTE) generally reflects central estimates of exposure or dose. For each of the receptors considered on Site (i.e., trespasser, angler, construction/utility worker, industrial/commercial worker, recreational user, and resident), both the RME and CTE exposure assessments were considered.

For each COPC, two different estimates of the CDI or EC, one for non-carcinogenic (systemic) effects and a second for carcinogens were calculated. The CDI or EC generally used in the assessment of non-carcinogenic effects is the average daily dose or exposure concentration an individual is likely to receive during the period of exposure. For carcinogens, the CDI or EC is estimated by averaging the total cumulative intake over a lifetime.

The CDIs and ECs for carcinogenic COPCs in surface soil, soil (surface and subsurface), groundwater, sediment, and surface water exposure scenarios utilize age adjusted exposure factors for lifetime exposure. These age adjusted intake factors take into account the fact that certain intake rates during adolescent and preadolescent (e.g., groundwater ingestion rates) may be substantially

greater on a mg/kg/day or mg/m^3 basis than the comparable values for an adult. In order to account for these differences in intake rates or exposure concentrations when estimating cancer risks, the exposure for both the child and adolescent receptors are combined with that of an adult to develop an age adjusted intake rate.

It is expected that chemicals with a mutagenic mode of action (those that can cause irreversible changes to DNA) would exhibit a greater effect in early life versus later life exposure. Cancer risk to children and adolescents includes both early life exposures that may result in the occurrence of cancer during childhood and early life exposures that may contribute to cancers later in life. In accordance with USEPA (2005a), separate cancer CDI/EC equations were utilized for the risk assessment of mutagens consistent with the equations used in the development of the Regional Screening Levels (RSLs) as presented in USEPA (2019a).

The intake equations for ingestion, dermal, and inhalation exposure to surface soil, soil (surface and subsurface), groundwater, sediment, and surface water applied in the HHRA are presented in the RAGS Part D Table 4 format along with exposure assumptions discussed below.

2.3.3.2 Specific Intake Equations

The following intake equations are the generic intake equations for the various exposure pathways. The intake equations for the mutagenic parameters were consistent with the equations used in the development of the RSLs presented in USEPA (2019a).

Soil/Sediment Incidental Ingestion Exposure Pathway

The chronic daily intake equation for calculating chemical intake from the incidental ingestion of soil/sediment after USEPA (1989) is:

$$CDI = \frac{CS \times IR \times EF \times ED \times CF}{BW \times AT}$$

Where:

CDI = Chronic daily chemical intake via ingestion (mg/kg body weight/day)
CS = Chemical concentration in soil/sediment (mg/kg)
IR = Ingestion rate (mg soil/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
CF = Conversion factor (10^{-6} kg/mg)
BW = Body weight (kg)
AT = Averaging time (averaging period, days)

Soil/Sediment Dermal Contact Exposure Pathway

The chronic daily intake equation for calculating chemical intake from dermal exposure to soil/sediment (USEPA, 1989) is:

$$CDI = \frac{CS \times SA \times AF \times ABS \times EF \times ED \times CF}{BW \times AT}$$

Where:

CDI = Chronic daily chemical intake via dermal contact (mg/kg body weight/day)
CS = Chemical concentration in soil/sediment (mg/kg)
SA = Skin surface area available for contact (cm^2/event)
AF = Soil to skin adherence factor (mg/cm^2)
ABS = Absorption factor - dermal (unitless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
CF = Conversion factor (10^{-6} kg/mg)
BW = Body weight (kg)
AT = Averaging time (averaging period, days)

Soil Particulate or Vapor Inhalation from Soil Exposure Pathway

The intake equation for calculating chemical intake from the inhalation of particulates or vapors originating from soil (USEPA, 2002) is:

$$EC = \frac{CS \times FT \times EF \times ED \times (1/PEF \text{ or } VF)}{AT}$$

Where:

EC = Exposure concentration via particulate or vapor inhalation (mg/kg body weight/day)
CS = Chemical concentration in soil (mg/kg)
FT = Fraction time exposed (unitless)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
PEF = Soil particulate emission factor (m^3/kg)
VF = Volatilization factor (m^3/kg)
AT = Averaging time (averaging period, days)

Groundwater/Surface Water Incidental Ingestion Exposure Pathway

The intake equation for calculating chemical intake from the incidental ingestion of groundwater/surface water after USEPA (1989) is:

$$CDI = \frac{CW \times IR \times EF \times ED}{BW \times AT}$$

Where:

CDI = Chronic daily intake via groundwater ingestion (mg/kg body weight/day)
CW = Chemical concentration in groundwater (mg/L)
IR = Ingestion rate (L/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)

AT = Averaging time (averaging period, days)

Groundwater/Surface Water Dermal Contact Exposure Pathway

The intake equation for calculating chemical intake from dermal exposure to groundwater/surface water (USEPA, 2004) is:

$$CDI = \frac{DA_{event} \times SA \times EV \times ABS \times EF \times ED}{BW \times AT}$$

Where:

The dose absorbed per unit area per event (DA_{event}) equation for calculating dermal exposure to groundwater (USEPA, 2004) is:

For Organic COCs:

$$\text{if } t_{event} \le t^*, \text{then } DA_{event} = 2 \times FA \times PC \times CW \times \sqrt{\frac{6 \times \tau_{event} \times t_{event}}{\pi}}$$

$$\text{if } t_{event} > t^*, \text{then } DA_{event} = FA \times PC \times CW \times \left[\frac{t_{event}}{1+B} + 2 \times \tau_{event} \times \left(\frac{1+3 \times B+3 \times B^2}{(1+B)^2} \right) \right]$$

For Inorganic COCs:

$$DA_{event} = PC \times CW \times t_{event}$$

Where:

DA_{event} = Dose absorbed per unit area per event (mg/cm^2-event)

FA = Fraction absorbed water (dimensionless)

PC = Dermal permeability coefficient of compound in water (cm/hr)

CW = Chemical concentration in groundwater (mg/m^3)

t_{event} = Event duration (hr/event)

τ_{event} = Lag time per event (hr/event)

t* = Time to reach steady state (hr) = 2.4 x τ_{event}

B = Dimensionless ratio of permeability coefficient of a compound through the stratum corneum relative to its permeability coefficient across the viable epidermis (dimensionless)

Groundwater Vapor Inhalation Exposure Pathway

The exposure concentration equation for calculating chemical intake from vapor inhalation exposure to groundwater (USEPA, 1989) is:

$$EC = \frac{CW \times FT \times EF \times ED \times VF}{AT}$$

Where:

EC	=	Exposure concentration via groundwater vapor inhalation (mg/m^3)
CW	=	Chemical concentration in groundwater (e.g., mg/L)
FT	=	Fraction of time exposed (hours per 24 hours) (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
VF	=	Volatilization factor (L/m^3)
AT	=	Averaging time (averaging period, days)

Fish Tissue Incidental Ingestion Exposure Pathway

The chronic daily intake equation for calculating chemical intake from the incidental ingestion of fish tissue after USEPA (2014) is:

$$CDI = \frac{A \times CR \times F \times EF \times ED}{AT}$$

Where:

CDI	=	Chronic daily chemical intake via ingestion (mg/kg body weight/day)
A	=	Chemical concentration in animal tissue (mg/kg)
CR	=	Consumption rate (kg/kg-day)
F	=	Fraction of animal consumed that is contaminated (unitless)
EF	=	Exposure frequency (days/year)
ED	=	Exposure duration (years)
AT	=	Averaging time (averaging period, days)

Carcinogens

A lifetime average daily dose or exposure concentration of the chemical was estimated for carcinogens. This prorates the total cumulative intake over a lifetime. An averaging time (AT) of 70 years was used for carcinogens.

Non-Carcinogens

The chemical intake of non-carcinogens was estimated over the appropriate exposure period or averaging time. The averaging time is the exposure duration assumed in the dose equation times 365 days per year.

The following sections provide intake equations for ingestion, dermal, and inhalation exposure to soil and groundwater which will be applied in the HHRA. In the HHRA, exposure estimates reflect chemical concentration, contact rate, exposure time, and body weight in a term called "intake" or "dose".

2.3.3.3 Exposure Scenario Assumptions

Different exposure scenarios were developed for each receptor population that were evaluated in the HHRA. Receptor characteristics had values assigned for CTE and RME scenarios. In some cases, these values differed between scenarios (e.g., exposure concentration, exposure frequency, etc.) and in other cases these values were the same for both CTE and RME scenarios (e.g., body weight, skin surface area, soil ingestion rate, etc.). The assignment of receptor characteristics by scenarios followed standard practices used by regulating agencies and risk assessment professionals. Table 2.1 provides a summary the exposure assumptions used for each of the receptors in the evaluations of the potential risk and hazards for the various exposure pathways identified in Section 2.2.2. The exposure assumptions for each receptor and exposure medium are also provide in RAGS Part D Table 4 format in Appendix A as detailed below.

Receptor	Exposure Media	Table Reference in Appendix A
Trespasser (current/future)	Surface Soil/Sediment	Table 4.1
	Surface Water	Table 4.19
Resident (current/future)	Surface Soil/Soil	Table 4.3
	Groundwater/Indoor Air	Table 4.10
Industrial/Commercial Worker	Surface Soil/Soil	Table 4.5
	Indoor Air	Table 4.9
Construction/Utility Worker	Soil	Table 4.7
	Groundwater	Table 4.12
	Sediment	Table 4.18
	Surface Water	Table 4.21
Recreational User	Floodplain Surface Soil	Table 4.15
Fish Eater	Fish Tissue	Table 4.16
Maintenance/Outdoor Worker	Floodplain Surface Soil	Table 4.23

To determine the potential inhalation exposure to the volatile COPC in soil volatilizing to ambient air, a volatilization factor (VF) was used to estimate the ambient air concentration based on the soil concentration. The VF is chemical-specific and was calculated using the approach presented in USEPA (2002). Site-specific soil and chemical-specific properties were used in calculating the VF. The equations and inputs for the calculated VF values are presented in Tables 4.2 (trespasser), 4.4 (resident), 4.6 (industrial/commercial worker), and 4.8 (construction/utility worker) of Appendix A.

Dermal exposure to groundwater and surface water was estimated through the use of the DA_{event}, which was used to represent the absorbed dose per event during dermal exposure to water, and was calculated using equations and inputs obtained from USEPA (2004). Tables 4.11 (resident) and 4.13 (construction/utility) of Appendix A present the DA_{event} calculation for exposure to groundwater. The DA_{event} calculation for dermal exposure to Quarry Pond surface water are presented in Tables 4.20 (trespasser) and 4.22 (construction/utility) of Appendix A.

The indoor air concentrations of the volatile and semi-volatile COPCs measured in groundwater and soil vapor were determined using the USEPA VISL calculator (2019b), as presented in Appendix C.

Inhalation of volatile COPCs originating from shallow groundwater within an excavation was modeled through the use of a VF to estimate ambient air concentrations based on the groundwater concentration. The VF is chemical specific and was calculated using the approach presented by USEPA (1999) (see Appendix D for a copy). The development of the VFs for COPCs in shallow groundwater volatilizing to ambient air is presented in Table 4.14 of Appendix A for the construction/utility worker.

To determine the fish eater indirect exposure of organic COPCs in sediment via ingestion of fish tissue, the biota to sediment accumulation factor (BSAF) method was used. For chlorinated organic compounds, the USEPA (2005b) recommended method was used to calculate BSAFs. For chlorinated organics, BSAFs are empirically derived-relationships between chemical concentrations measured in sediment and in fish in overlying waters. Because bioaccumulation is directly correlated to the lipid content of the fish and inversely related to the carbon content of the sediments, BSAFs are generally normalized to fish lipid and sediment carbon. As USEPA provides BSAFs only for Aroclors, however, the same value (2.0) was also applied to the detected pesticides (DDT, DDE, DDD, heptachlor epoxide). These pesticides are equally hydrophobic and as difficult to metabolize as PCBs and, thus, tend to bioaccumulate/biomagnify similarly to PCBs (Tracey and Hansen 1995).

Estimating bioaccumulation of PAHs by fish is complicated. Although the more toxic PAHs are as hydrophobic as PCBs and chlorinated pesticides, the PAHs do not biomagnify or even bioaccumulate readily because the PAHs are readily metabolized by a variety of taxa (Broman et al. 1990; Thomann and Komlos 1999). In addition, some of the higher molecular weight PAHs are poorly assimilated across the gills and guts of fish such that total bioaccumulation of the most hydrophobic PAHs is further reduced. Because of these constraints, observed fish bioaccumulation rates of very hydrophobic PAHs may be 4 to 6 orders of magnitude lower than rates observed for similarly hydrophobic PCBs (Thomann and Komlos 1999). Therefore, fish concentrations of the PAH COPCs were estimated with the model of Thomann and Komlos (1999). This model successfully mimics empirical data for bioaccumulation of PAHs by sunfish in a small stream (Burkhard and Sheedy, 1995), with ongoing inputs of PAHs to both water and sediments. The Thomann and Komlos (1999) model predicts BSAFs for PAHs as function of the K_{ow} of the PAH, the lipid concentrations in fish, and the organic carbon concentrations in sediments. Using the model's best fit (Figure 11 of that reference), concentrations of PAH were predicted in fish based on log K_{ow} values supplied by USEPA (2003a).

The BSAF methods should give very conservative estimates of fish concentrations since the empirical values, especially those for PAHs, pertain to ongoing releases where fish would be exposed via sediments, water, and food chains dependent on both media. In contrast, the COPCs concentrations in sediments at the Site are mostly from past loadings and thus bioaccumulation pathways from water at the Site are negligible.

In contrast to the organics, there are no widely used BSAF methods to estimate metal concentrations in fish. However, there are commonly used regression equations to estimate metal concentrations in benthos (Bechtel Jacobs, 1998), and these were used to estimate fish concentrations assuming that fish had the same concentrations as benthos. This will typically be a quite conservative assumption since 1) metals tend to biodilute in food chains, such that fish are

expected to have generally lower metals concentrations than their prey; and 2) fish will consume prey from water column food chains that are not affected by sediment contaminations. Regression models based on all data (depurated and non-depurated) from Table 3 of Bechtel Jacobs (1998) were used to predict metals concentrations in fish. These models predict dry-weight concentrations in biota. These were converted to wet-weight concentrations by assuming that benthos and fish are 75 percent water (USEPA, 2011). It should be noted that Bechtel Jacobs (1998) has no regression models for silver and selenium. Thus, a very conservative BSAF of 1 was used for these two metals. This is likely very conservative since the median BSAF for the regression models was about 0.06, and this did not include losses from benthos to fish.

Methyl mercury is an exception to most other metals in that it tends to bioaccumulate in food chains, making the assumption that fish concentrations equal benthos concentrations not conservative. A geometric mean of the BSAF values presented in in the Amec Foster Wheeler (2017) Technical Memorandum for the Penobscot River was used.

The equations and inputs for the calculated values for fish concentrations based on sediment concentrations are presented in Table 4.17 of Appendix A.

To determine the fish eater indirect exposure of COPCs in surface water via ingestion of fish tissue, the bioconcentration factor (BCF) method was used. The BCF values were obtained from the ambient water quality criteria (USEPA, 1980) for arsenic and thallium. For manganese, the BCF was obtained from ODEQ (2010). The equations and inputs for the calculated values for fish concentrations based on surface water concentrations are presented in Table 4.18 of Appendix A.

2.3.4 Evaluation of Non-Residential Adult Exposures to Lead

As per USEPA guidance (USEPA, 2010), and given that the arithmetic mean lead concentrations in surface soil and soil exceeded USEPA Regional Screening Levels/health-based action levels, the levels of fetal blood lead due to maternal exposure via the ingestion of Site media will be quantified using the USEPA ALM methodology (USEPA, 2009b), "Recommendations of the Technical Review Workgroup for Lead for an Approach to Assessing Risks Associated with Adult Exposures to Lead in Soil" (USEPA, 2003b), the ALM "Frequently Asked Questions" (FAQ) website (USEPA, 2013a), and the "Transmittal of Update to the Adult Lead Methodology's Default Baseline Blood Lead Concentration and Standard Deviation Parameters" (USEPA, 2009b and 2017).

The hazard associated with adult lead exposure stems from the relationship between the lead concentration in site media and the blood lead concentration in the developing fetus of a pregnant woman exposed to site media. Current Office of Solid Waste and Emergency Response (OSWER) guidance calls for the establishment of cleanup goals to limit childhood risk of exceeding 10 μg/dL to 5 percent of the population.

Lead was identified as a COPC in surface soil, soil (surface and subsurface), and groundwater. As such it is reasonably anticipated that a construction/utility worker performing excavations on Site would contact lead in these media. Additionally, a trespasser and industrial/commercial worker may be exposed to the lead concentrations. However, as the average exposure frequency for trespasser is only 58 days/year, the lead exposure for this receptor was considered to be low and not of concern and therefore lead exposure will not be evaluated further. Groundwater is only shallower than 15 feet BGS in EUs 1 and 19, therefore exposure to lead in groundwater by a

construction/utility worker might occur during ground intrusive activities. However, as exposure to groundwater during these intrusive activities is considered to be incidental and therefore will not be significant contribution to the lead exposure. Therefore, exposure to lead in groundwater will not considered further. The adult lead model (ALM) will be used to assess lead exposure to the current/future industrial/commercial worker (surface soil) and future construction/utility worker (through soil). Lead was identified as COPC in EU3, EU3-EU4, EU9, and EU13 to EU19 surface soil and/or soil data sets. All other EUs had maximum concentrations below the lead screening level and therefore will not be evaluated further for exposure to lead. As the average lead concentration within surface soil (EU3 [190 mg/kg], EU3-EU4 [116 mg/kg]) and soil (EU3 [132 mg/kg], EU3-EU4 [80 mg/kg], EU9 [152 mg/kg]) were below the USEPA RSL of 400 mg/kg, the current/future industrial/commercial worker (through surface soils), and the future construction/utility worker (through soil) will not be evaluated further for exposure to these media in these EUs. The EUs and receptors that will be evaluated using the ALM are presented in the table below. The mean lead concentrations presented in the table below are based on the fine fraction with the exception of EU16 soil which is based on the mean of the bulk lead analysis as the fine fraction concentration was below the screening level.

Receptor	Exposure Media	Mean Lead Concentration (mg/kg)
industrial/commercial	EU13 Surface soil	3,400
construction/utility worker	EU13 Soil	3,400
industrial/commercial	EU14 Surface soil	15,800
construction/utility worker	EU14 Soil	15,800
industrial/commercial	EU15 Surface soil	1,575
construction/utility worker	EU15 Soil	1,575
construction/utility worker	EU16 Soil	2,321
industrial/commercial	EU17 Surface soil	775
industrial/commercial	EU18-EU19 Surface soil	1,046

Therefore, the fetal 95th percentile blood lead level will be conservatively estimated for adult women industrial/commercial worker and construction/utility worker with Site soil exposure using the following model described below in Sections 2.3.4.1 (Adult Lead Exposure Equation) and 2.3.4.2 (Adult Lead Exposure Equation Input Parameters).

2.3.4.1 Adult Lead Exposure Equation

The TRW has indicated that the Adult Exposure Equation is a suitable and appropriate model for assessing adult exposures to lead under an industrial setting. The Adult Exposure Equation recommended for use by the TRW is as follows:

$$PbB_{fetal,0.95} = \left(PbB_{adult,0} + PbB_{adult,site}\right) \times GSD_{i,ad\ ult}^{1.645} \times R_{\ fetal/maternal}$$

Where:

$PbB_{fetal,\ 0.95}$ = 95th percentile target blood lead (PbB) concentration in the fetus (μg/dL);

$PbB_{adult,0}$ = typical lead concentration (μg/g) (appropriate average concentration for individual);

$R_{fetal/maternal}$ = mean ratio of fetal to maternal PbB;

$GSD_{i,adult}$ = individual Geometric Standard Deviation, an exponent of 1.645 represents the standard normal deviate used to calculate the 95th percentile from a lognormal distribution of blood lead concentration; and

$PbB_{adult,\ site}$ = adult blood lead concentration (µg/dL) contributed by exposure to lead containing media on site as shown below.

$$PbB_{adult,site} = \frac{BKSF \times PbS \times IR_S \times AF_S \times EF_S}{AT}$$

Where:

BKSF = BioKinetic Slope Factor (µg/dL blood lead increase per µg/day lead uptake);

PbS = Soil Lead Concentration (µg/g);

IR_S = Ingestion Rate of soil (g/day);

EF_S = Exposure Frequency for contact with assessed soils (days/yr);

AF_S = absolute Absorption Fraction of lead in soil;

AT = Averaging Time.

2.3.4.2 Adult Lead Exposure Equation Input Parameters

The basis for selection of input parameters for the above model is discussed below.

(i) Media Lead Concentrations (PbS):

- The exposure unit specific RME concentrations of lead in the media will be used.

(ii) Mean Ratio of Fetal to Maternal PbB ($R_{fetal/maternal}$):

- Various studies have estimated an average fetal-to-maternal PbB ratio of 0.9 based on a weight of evidence approach. This value has also been used by USEPA in applying the Adult Exposure Model. The value of 0.9 will be used in the modeling.

(iii) Individual Geometric Standard Deviation ($GSD_{i,adult}$):

- This parameter is used to assess variability in blood lead concentrations among different individuals. Few data are available regarding GSD values reflecting individual variability. Instead, GSD values reflecting community variability (which would be expected to be greater than individual variability) are frequently applied to estimate individual variability. Various studies have indicated that community GSDs may range from approximately 1.8 to 2.1 depending on the demographics. A value for GSD of 2.1 will be used in this modeling based on the TRW Lead guidance assuming a heterogeneous population.

(iv) Baseline PbB Value ($PbB_{adult,0}$):

- This parameter is specific to the population in the area of interest. At this time, no source of data describing blood lead levels for the population in the vicinity of the site has been identified. Therefore, published reference data were used to determine a representative value. Various studies have indicated that Baseline PbB values range from approximately

1.7 to 2.2 depending on the demographics. A value of 1.9 μg/dL will be used for this input parameter based on the TRW Lead guidance.

(v) Biokinetic Slope Factor (BKSF in μg/dL per μg/day):

- The TRW adopted a BKSF of 0.4, derived for the baseline human health risk assessment for the California Gulch Superfund Site. The default value of 0.4 for the parameter BKSF will be used in the modeling.

(vi) Soil Absolute Absorption Fraction of Lead (AF_s and AF_D):

- The TRW uses 12 percent as the absorbed fraction of lead from soil for adults, based on an absorption factor for soluble lead of 0.20 and a relative bioavailability of 0.6 (soil/soluble).

(vii) Soil Ingestion Rate (IR_s in g/day):

- Soil ingestion rates of 0.1 g/day and 0.330 g/day will be used for an industrial/commercial worker and construction/utility worker, respectively at the Site (USEPA, 2002b).

(viii) Exposure Frequency (EF_S in days/yr):

- The TRW applies default value of 219 days/year based on the average time spent at work by both full-time and part-time workers. However, for the construction/utility worker scenario, an exposure frequency of 60 days/year (5 days per week for 3 months) will be used as an average or mean exposure in the modeling.

(ix) Averaging Time (AT in days):

- The TRW applies default value of 365 days/year based on the average time spent at work by both full-time and part-time workers which will be applied for the industrial/commercial worker. However, for the construction/utility worker scenario, an averaging time of 91 days/year will be used based on the 60-day/year exposure frequency.

2.3.5 The Integrated Exposure Uptake Biokinetic (IEUBK) Model for Lead

The IEUBK model for lead exposure in children will be used to determine exposure levels for potential future residents on Site based on the assumption that the child resident is considered to be more sensitive than the adult resident. The IEUBK model for lead provides a method for predicting blood lead levels in populations exposed to lead in several different media. The impetus for the development of this model was the USEPA's conclusion that a threshold does not exist for many of the non-cancer effects of lead in infants and young children. The IEUBK Model is a simulation model which uses mathematical equations to estimate the lead level in blood (PbB) of a child (or population of children) in the 0- to 7-year age group who are exposed to lead in various media such as soil, air, diet, water, and other potential sources. The IEUBKwin32 Model 1.1, Build 11 (USEPA, 2010) was used to determine the blood lead concentration for residents from exposure to Site soil.

For this evaluation, the intake of lead was determined for various direct and secondary exposure pathways, including the ingestion of soil, dust particles and municipal drinking water, inhalation of air and dietary intake (i.e., produce, animal products, and fish). As indicated above, young children are considered to be unimpacted when the model predicts that less than 5 percent of children will have blood lead levels greater than 10 μg/dL. Default lead concentrations in air of 0.100 μg/m^3 and in

drinking water of 4 µg/L were used as inputs into the IEUBK model. The model default values were utilized for the dietary lead intake for each age range. Using these default lead concentrations in air, and the default dietary lead intake levels, the IEUBK model was run to determine the blood lead level concentration. The default mother's blood lead concentration at childbirth that is in the IEUBK Model is 1 µg/dL. The IEUBK Model assumes that the maternal blood lead at the time of delivery is stored in the newborn child tissues. Based on the analysis of the NHANES 2009-2014 data, USEPA (2017) has recommended that the Mother's Blood Lead Concentration at Childbirth (MatPb) value in the IEUBK Model be updated to 0.6 µg/dL. Therefore, a value of 0.6 µg/dL was used for the MatPb value.

The IEUBK Model will be used to predict the blood lead level within a hypothetical future child resident exposed to lead within surface soils in the EU13, EU14, EU15, EU17, and EU18-EU19 where the average lead concentrations are above 400 mg/kg (USEPA default value). As noted above, lead was also identified as COPC in EU3 and EU3-EU4 surface soil, however, the average of the surface soil concentrations are below the screening level. The IEUBK Model inputs and outputs for each exposure unit evaluated will be presented in the baseline HHRA submission.

3. HHRA Step 3 and Step 4

Following approval of the RAAD, the remaining portions of the baseline HHRA will be completed. This section includes a description of the methodology that will be applied for Step 3 (Toxicity Assessment) and Step 4 (Risk Characterization).

3.1 Toxicity Assessment

The toxicity assessment provides chemical-specific quantitative dose-response data for each COPC. The toxicity information for each COPC has been obtained from the hierarchy of information recommended by USEPA (USEPA, 2003c & 2013b). Based on this guidance, the toxicity values have been selected from the following sources:

- Tier 1: Integrated Risk Information System (IRIS) database.
- Tier 2: Provisional Peer Reviewed Toxicity Values as listed in the USEPA Regional Screening Level (RSL) table.
- Tier 3: Additional USEPA and non-USEPA sources including historical National Center for Environmental Assessment (NCEA) provisional values, Agency for Toxic Substances and Disease Registry (ATSDR) minimal risk levels (MRLs), and the Health Effects Assessment Summary Tables (HEAST) as listed in the USEPA Regional Screening Level (RSL) table.

The non-carcinogenic and carcinogenic toxicity values have been presented in RAGS Part D Tables 5 and 6 format in Appendix A and as referenced in the below sections.

3.1.1 Non-carcinogenic Hazards

For substances suspected to cause non-carcinogenic chronic effects, the health criteria are usually expressed as acceptable chronic daily intake levels or RfDs (in units of mg/[kg-day]) or acceptable chronic exposure levels or RfCs (in units of mg/m^3), below which no adverse effects are expected.

Therefore, toxicity values for non-cancer health effects are based on a threshold concept or a level of exposure to a chemical below which no toxic effects are expected.

As noted previously, chronic RfDs and RfCs are defined as an estimate (with an uncertainty spanning an order of magnitude or greater) of a daily exposure level for the human population, including sensitive sub populations, which poses no appreciable risk of deleterious effects over a lifetime of exposure. RfDs and RfC are typically derived from studies in humans or laboratory animals. Uncertainty factors are used (a) to extrapolate animal toxicity data to humans, (b) to protect sensitive sub populations of humans, and (c) to account for database quality.

To derive a RfD or RfC, a critical study is selected that usually includes the highest dose/concentration level administered to laboratory animals that did not cause observable adverse effects after repeated (usually lifetime) exposure. This is called a No Observed Adverse Effect Level (NOAEL). The NOAEL is then divided by uncertainty (safety) factors, and sometimes an additional modifying factor, to obtain the RfD or RfC. In general, an uncertainty factor of 10 is used to extrapolate laboratory animal results to humans and another factor of 10 to account for sensitive human populations. Additional uncertainty factors of 10 are included if the critical study only identified a Lowest Observed Adverse Effect Level (LOAEL) instead of the NOAEL, or if the critical study was a subchronic (less than a lifetime) study. A modifying factor (MF) of 1 to 10 may also be included to address data sets lacking certain key studies. These factors are multiplied together and used along with the NOAEL or LOAEL to derive an RfD or RfC as follows:

$$\text{RfD or RfC} = \frac{\text{NOAEL or LOAEL}}{UF_1 \times UF_2 \times UF_3 \ldots}$$

RfDs and RfCs are developed for the oral and the inhalation exposure routes, respectively. These are an oral reference dose (RfD) in units of mg/kg-day and a reference concentration (RfC) in units of mg/m^3.

Table 5.1 of Appendix A presents the non-cancer toxicity data used to estimate human health effects for the oral and dermal exposure routes. Table 5.2 of Appendix A presents the non-cancer toxicity data used to estimate human health effects for the inhalation exposure route.

3.1.2 Carcinogenic Risks

Cancer Slope Factors (CSFs) and inhalation unit risk factors (URFs) are quantitative estimates of carcinogenic potency. Slope factors and URFs relate the lifetime probability of cancer to the lifetime exposure dose/concentration of a substance. CSFs and URFs are estimated using mathematical extrapolation models, and are presented as risk per dose or mg/(kg-day) (i.e., mg carcinogen per kg body weight per day) for oral CSFs and risk per concentration or mg/m^3 for inhalation URFs. The mathematical extrapolation models assume low dose linearity and thus may not be appropriate for some suspect carcinogens, in particular those that function as promoters. In addition, the body's natural repair processes and defense mechanisms may decrease cancer risk at low exposure levels. Thus, the risks at lower exposure levels are likely overestimated using linear low dose modeling.

When adequate human epidemiology data are available, maximum likelihood estimates (MLEs) are used to generate a CSF or URF. However, when animal data are used to derive a CSF or URF, the

upper 95 percent confidence limit on the MLE is used. Therefore, the true risk to humans, while not identified, is not likely to exceed the upper bound estimate. This is a conservative estimate, and in some cases the true slope may be zero (i.e., no carcinogenic risk).

Historically, known or suspect human carcinogens were evaluated and identified by the Carcinogen Assessment Group using the USEPA Weight of Evidence approach for carcinogenicity classification (USEPA, 2005). Most constituents currently listed in the USEPA Integrated Risk Information System (IRIS) still retain this classification. The USEPA classification was based on an evaluation of the likelihood that the agent is a human carcinogen. The evidence was characterized separately for human and animal studies as follows:

Group A Known Human Carcinogen (sufficient evidence of carcinogenicity in humans)

Group B Probable Human Carcinogen (B1 - limited evidence of carcinogenicity in humans; B2 - sufficient evidence of carcinogenicity in animals with inadequate or lack of evidence in humans)

Group C Possible Human Carcinogen (limited evidence of carcinogenicity in animals and inadequate or lack of human data)

Group D Not Classifiable as to Human Carcinogenicity (inadequate or no evidence)

Group E Evidence of Noncarcinogenicity for Humans (no evidence of carcinogenicity in animal studies)

Currently, USEPA uses a *weight of evidence* narrative to explain the human carcinogenic potential of a chemical, and the conditions that characterize its expression. For this purpose, USEPA uses the following descriptors:

Carcinogenic to Humans:

- Strong evidence of human carcinogenicity.

Likely to Be Carcinogenic to Humans:

- Evidence is adequate but not sufficient of Carcinogenic to Humans classification.

Suggestive Evidence of Carcinogenic Potential:

- Evidence is suggestive of carcinogenicity but the data are judged not sufficient for a stronger conclusion.

Inadequate Information to Assess Carcinogenic Potential:

- Data are judged inadequate for applying one of the other descriptors.

Not Likely to Be Carcinogenic to Humans:

- Available data are considered robust for deciding that there is no basis for human hazard concern.

Table 6.1 of Appendix A presents the cancer toxicity data used to estimate the risk of cancer for the oral and dermal exposure routes. Table 6.2 of Appendix A presents the cancer toxicity data used to estimate the risk of cancer for the inhalation exposure route.

Chemicals with a mutagenic mode of action would exhibit a greater effect in early-life versus later-life exposure. For mutagenic chemicals, cancer risk to preadolescents and adolescents includes both early-life exposures that may result in the occurrence of cancer during childhood and early-life exposures that may contribute to cancers later in life. As such, in accordance with USEPA (2005), separate cancer CDI/EC equations will be used for the risk assessment of mutagens.

3.1.3 Dermal Toxicity

Typically, IRIS toxicity values (RfDs, CSFs) are based on administered dose. To characterize risk from the dermal exposure pathway, adjustment of the oral toxicity factor to represent an absorbed dose rather than administered dose may be necessary. This adjustment accounts for the absorption efficiency in the "critical study" which forms the basis of the RfD or CSF. For example, in the case where oral absorption in the critical study is essentially complete (i.e., 100 percent), the absorbed dose is equivalent to the administered dose, and therefore no toxicity adjustment is necessary (USEPA, 2004). When gastrointestinal (GI) absorption of a chemical in the critical study is poor (i.e., 1 percent), the absorbed dose is much smaller than the administered dose, and therefore toxicity factors based on the absorbed dose must be adjusted for the difference in the absorbed dose relative to the administered dose.

The magnitude of toxicity factor adjustment is inversely proportional to the absorption fraction in the critical study. Thus, when the absorption efficiency in the critical study is high, the absorbed dose approaches the administered dose resulting in little difference in a toxicity factor derived from either the absorbed or administered dose. As absorption efficiency in the critical study decreases, the difference between the absorbed dose and the administered dose increases. At some point, a toxicity factor based on absorbed rather than administered dose needs to account for this difference in dose. A cutoff of 50 percent GI absorption is recommended by USEPA (2004) to reflect the intrinsic variability in the analysis of absorption studies. This cutoff level obviates the need to make comparatively small adjustments in the toxicity value that would otherwise impart on the process a level of accuracy that is not supported by the scientific literature (USEPA, 2004). Oral to dermal adjustment factors consistent with Exhibit 4-1 of USEPA (2004) that will be applied in the HHRA are presented in Tables 5.1 and 6.1 of Appendix A.

3.2 Risk Characterization

Risk characterization is the description of the nature and magnitude of potential human health risks, including attendant uncertainty. Risk characterization integrates the results of the exposure assessment and the toxicity assessment to characterize cumulative risks to the affected population. The risk characterization section will include quantitative estimates of potential carcinogenic risk and non-carcinogenic hazards associated with exposure to site-specific COPCs. Risks and hazards will be combined across all applicable pathways for a receptor group at a given exposure time for each COPC. Cumulative risks and hazards from all applicable COPCs and exposure pathways will be presented.

To characterize potential non-carcinogenic effects, comparisons will be made between projected doses and toxicity criteria (e.g., RfD or RfC). Potential non-carcinogenic effects will be assessed using a Hazard Quotient (HQ) approach. Constituent and route-specific HQs will be calculated for

exposure to all non-carcinogenic COPCs for each receptor. As appropriate, HQs across target organs or systems will be summed to calculate a Hazard Index (HI) for a given health effect to account for additivity of COPCs. An HI of less than one typically indicates it is unlikely for even sensitive populations to experience adverse health effects. Thus, if an HI exceeds the USEPA target HI of 1 (USEPA, 2018), the potential for non-cancer effects exists.

In order to characterize potential carcinogenic effects, probabilities that an individual will develop cancer over a lifetime of exposure will be estimated from projected intakes and chemical-specific toxicity information. Dose estimates for carcinogens will be multiplied by the chemical-specific carcinogenic toxicity values (e.g., CSF or URF) to produce estimates of incremental carcinogenic risks for each COPC and exposure route. Carcinogenic risks will be summed across constituents to produce medium-specific risk estimates for each scenario. When appropriate, medium-specific risks may be summed. The USEPA (2018) recommends an acceptable target cancer risk of 1×10^{-6} to evaluate the need for corrective action or mitigation at a site. The cumulative risks were compared to this target cancer risk.

The objective of the risk characterization is to integrate information developed in the exposure assessment, for complete exposure pathways, for detected COPCs that may have exceeded screening levels, and the toxicity assessment into an evaluation of the potential human health risks associated with potentially completed exposures to potentially contaminated media. The methods to be used in the risk characterization will be based on USEPA guidance documents for human exposures (USEPA, 1989, 1991, 2000, 2002, 2004, 2005, 2009a, 2011, 2014, 2018).

3.3 Hazard Estimates

The potential for non-cancer health effects from exposure to a COPC will be evaluated by comparing an exposure level over a specified time period to a RfD or RfC for a similar time period. This ratio, termed the hazard quotient, is calculated according to the following general equation:

For oral and dermal exposure:

$$HQ = \frac{CDI}{RfD}$$

For inhalation exposure:

$$HQ = \frac{EC}{RfC}$$

Where:

HQ = Hazard quotient (unitless), the ratio of the exposure dose of a chemical to a reference dose not expected to cause adverse effects from a lifetime exposure. A hazard quotient equal to or less than 1 is considered protective of human health.

CDI = The Chronic Daily Intake, or exposure, is the chemical dose calculated by applying the exposure scenario assumptions and expressed as mg/(kg-day). The intake represents the average daily chemical dose over the expected period of exposure.

EC = The Exposure Concentration in air is calculated by applying the exposure scenario assumptions and is expressed as mg/m^3 for inhalation exposure.

RfD = Reference dose is a daily dose believed not to cause an adverse effect from even a lifetime exposure (mg/[kg-day]). The RfD is based on experimental data and/or epidemiological studies.

RfC = The Reference Concentration is a daily concentration believed not to cause an adverse effect from even a lifetime exposure [mg/m^3]. The RfC is based on experimental data.

The Hazard Index (HI) for an exposure situation is the sum of the HQs estimated for the individual COPCs. An HI less than 1 is considered health protective for a lifetime exposure and is therefore not an exposure of concern. If the HI is greater than 1, it may be appropriate to reevaluate the toxicity of the individual COPCs to determine if individual chemicals have the same or differing toxicological endpoints that would support conclusions that the HQs should or should not be added.

Non-cancer hazard estimates will be established for all receptors for the RME scenario based on the respective exposure durations.

3.4 Cancer Risk Estimates

Exposure scenarios may involve potential exposure to more than one carcinogen. To represent the potential carcinogenic effects posed by exposure to multiple carcinogens, it is assumed, in the absence of information on synergistic or antagonistic effects, that these risks are additive. Cancer risks will be calculated utilizing the following general equation:

For oral/dermal exposure:

$$\text{Cancer Risk} = \text{CDI} \times \text{CSF}$$

For inhalation exposure:

$$\text{Cancer Risk} = \text{EC} \times \text{URF}$$

Where:

Cancer Risk = Estimated upper bound on additional risk of cancer over a lifetime in an individual exposed to the carcinogen for a specified exposure period (unitless).

CDI = The Chronic Daily Intake due to exposure to the chemical is calculated using exposure scenario assumptions and is expressed as mg/(kg-day) for ingestion and dermal contact exposures. The chronic daily intake represents the total lifetime chemical dose averaged over an individual expected lifetime of 70 years.

EC = The exposure concentration in air calculated by applying the exposure scenario assumptions and is expressed as mg/m^3 for inhalation exposure.

CSF = Cancer slope factor models the potential carcinogenic response and is expressed as [mg/(kg-day)]$^{-1}$.

URF = The inhalation Unit Risk Factor models the potential carcinogenic response and is expressed as [mg/m^3]$^{-1}$.

For estimating cancer risks from exposure to multiple carcinogens from a single exposure route, the following equation is used:

$$\text{Risk}_T = \sum_{i=1}^{N} \text{Risk}_i$$

Where:

Risk_T = Total cancer risk from route of exposure.

Risk_i = Cancer risk for the chemical.

N = Number of chemicals.

The potential cumulative risks resulting from exposure to the COPCs will be compared to the cumulative target risk of 1×10^{-6} or 1 in 1,000,000, in accordance with USEPA (2018).

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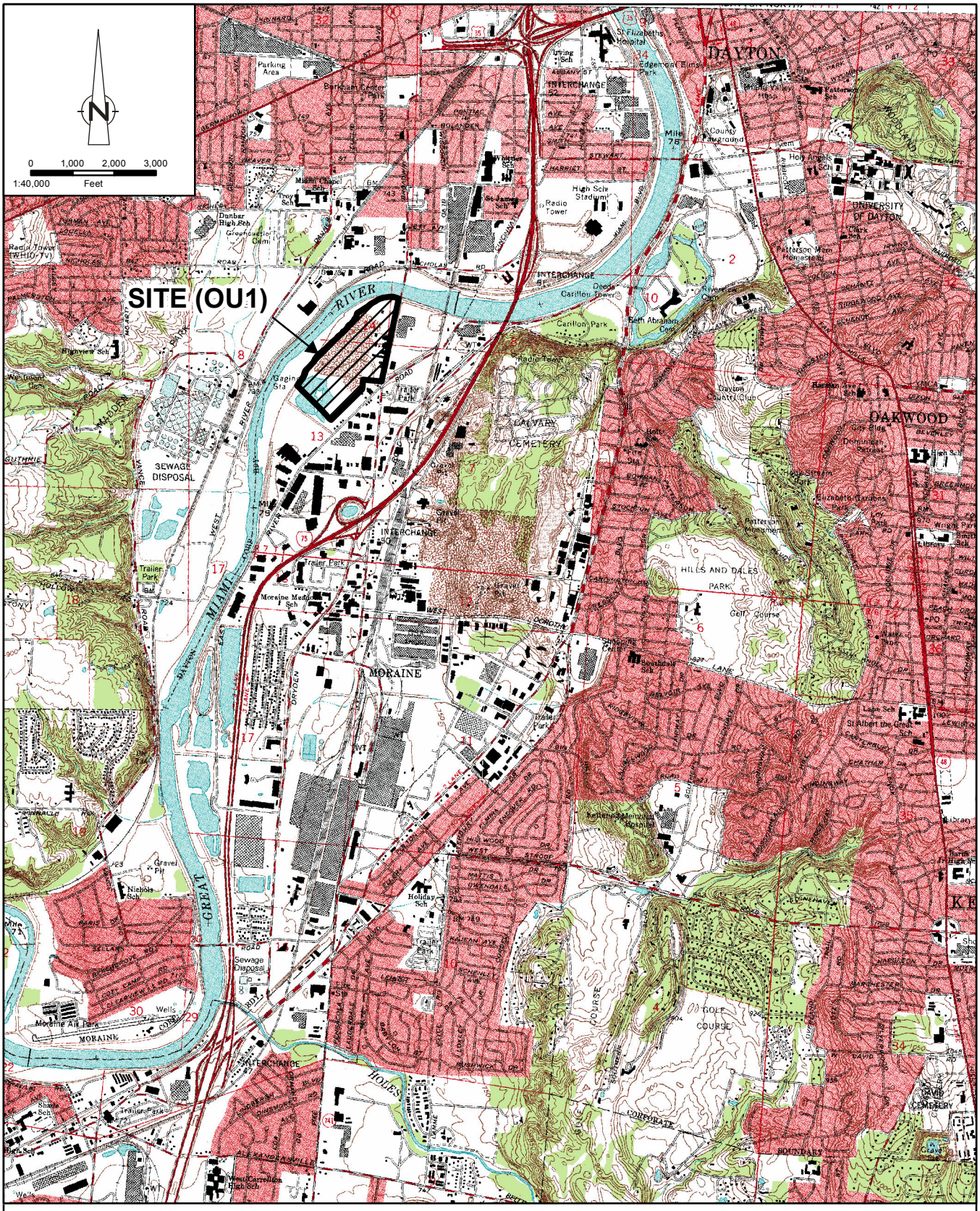

figure 1.1

SITE LOCATION MAP
SOUTH DAYTON DUMP & LANDFILL SITE
Moraine, Ohio

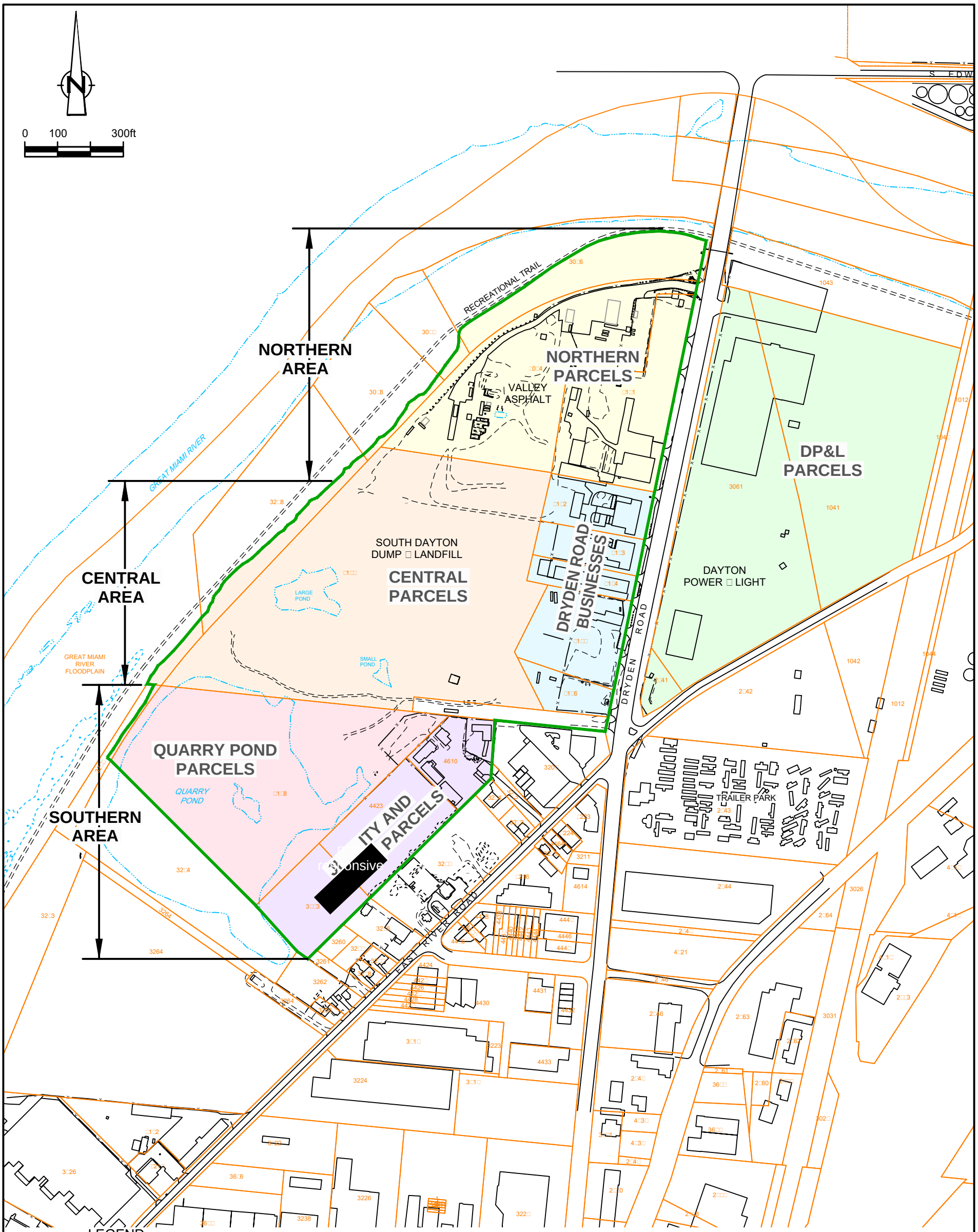

figure 1.2

OPERABLE UNIT ONE (OU1) BOUNDARY SOUTH DAYTON DUMP AND LANDFILL SITE

Moraine, Ohio

SOURCES:
THE PAYNE FIRM, INC., PROJECT 02□□44.0□, FIGURE 1, DATED □/12/0□□
TETRA TECH EM INC., PROJECT L0312006-SOUTH DAYTON DUMP, FIGURE 2, SITE LAYOUT, 0□/2□/2004□
CITY OF MORAINE.
ABRAMS AERIAL SURVEY INC. PROJECT 38443, AASI 2□610, 04/02/2008

N:\CA\Waterloo\Legacy\CAD\drawings\38000s\38443\38443-REPORTS\38443-410(036)\38443-410(036)GN\38443-410(036)GN-WA001.DWG Plot Date: MAR 30, 2020

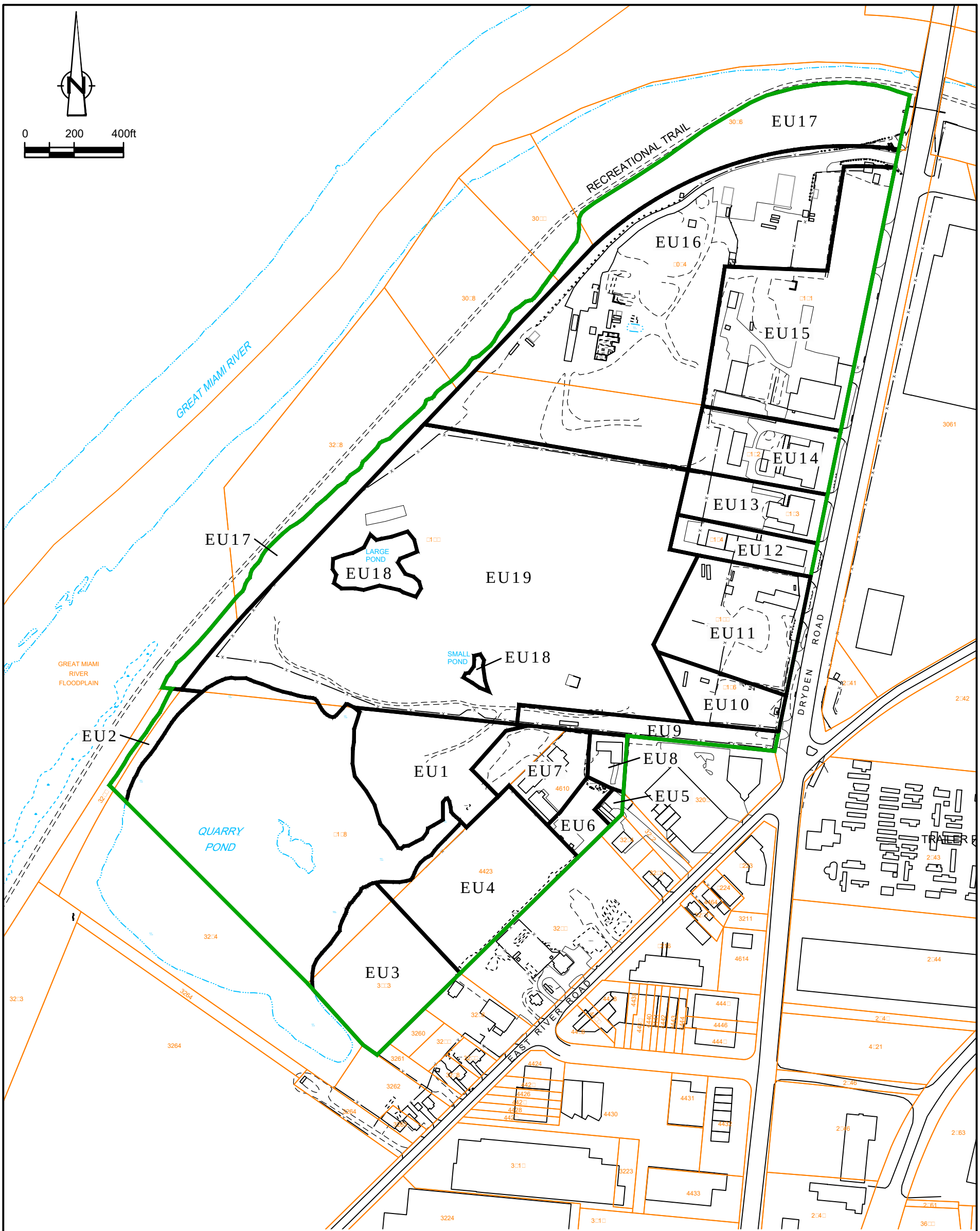

figure 1.3

EXPOSURE UNITS
SOUTH DAYTON DUMP AND LANDFILL SITE
Moraine, Ohio

SOURCES:
THE PAYNE FIRM, INC., PROJECT 02□□.44.0□, FIGURE 1, DATED □/12/0□□
TETRA TECH EM INC., PROJECT L0312006-SOUTH DAYTON DUMP, FIGURE 2, SITE LAYOUT, 0□/2□/2004□
CITY OF MORAINE.
ABRAMS AERIAL SURVEY INC. PROJECT 38443, AASI 2□610, 04/02/2008

N:\CA\Waterloo\Legacy\CAD\drawings\38000s\38443\38443-REPORTS\38443-410(036)\38443-410(036)GN\38443-410(036)GN-WA002.DWG Plot Date: MAR 30, 2020

PRIMARY SOURCE	release mechanism	SECONDARY SOURCE	release mechanism	TERTIARY SOURCE	release mechanism	EXPOSURE ROUTE	RECEPTOR CHARACTERIZATION										
							POTENTIALLY EXPOSED RECEPTORS (HUMAN HEALTH - BASELINE CONDITIONS)										
							OU1 Parcels (excluding Quarry Pond)				Quarry Pond		Properties outside OU1			GMR / floodplain	
							Residents [1]	Site Workers	Temporary Workers	Trespassers	Temporary Workers	Trespassers	Residents / workers	Temporary Workers	Trespassers	Recreation users	Temporary Workers
PORTIONS OF SURFACE AND SUBSURFACE FILL MATERIAL CONTENTS (within OU1)	direct contact					INCIDENTAL INGESTION DERMAL CONTACT	X	X	X	X	na	na	na	na	na	na	na
	waste decomposition/ volatilization	SUBSURFACE GAS / VAPOR	subsurface migration	INDOOR AIR	dispersion	INHALATION OF VAPORS (and accumulation of explosive gas)	X	X	--	--	--	--	X	--	--	--	--
			discharge to atmosphere	AMBIENT AIR	dispersion	INHALATION OF VAPORS	X	X	X	X	X	X	X	X	X	X	X
	volatilization/ wind erosion	AMBIENT AIR/ FUGITIVE DUST	dispersion			INHALATION OF VAPORS/ PARTICULATES	X	X	X	X	X	X	X	X	X	X	X
			dispersion/deposition	SURFACE DEPOSITION TO SOIL	direct contact	INCIDENTAL INGESTION DERMAL CONTACT	X	X	X	X	X	X	X	X	X	X	X
	storm water runoff	SURFACE WATER i.e., intermittent drainage pathways	direct contact			INCIDENTAL INGESTION DERMAL CONTACT	X	X	X	X	na	na	X	X	X	X	X
		SEDIMENTS AND SOIL i.e., intermittent drainage pathways	direct contact			INCIDENTAL INGESTION DERMAL CONTACT	X	X	X	X	na	na	X	X	X	X	X
	storm water runoff	PONDS i.e., existing intermittent ponds (Large Pond and Small Pond)	water circulation	SURFACE WATER	direct contact volatilization	INCIDENTAL INGESTION DERMAL CONTACT INHALATION OF VAPORS	X	X	X	X	na	na	na	na	na	na	na
			sedimentation	SEDIMENT	direct contact	INCIDENTAL INGESTION DERMAL CONTACT	X	X	X	X	na	na	na	na	na	na	na
			recharge to gw	GROUNDWATER see below													
	storm water runoff	QUARRY POND	water circulation	SURFACE WATER	direct contact volatilization	INCIDENTAL INGESTION DERMAL CONTACT INHALATION OF VAPORS	na	na	na	na	X	X	na	na	na	na	na
			sedimentation	SEDIMENT	direct contact	INCIDENTAL INGESTION DERMAL CONTACT	na	na	na	na	X	X	na	na	na	na	na
			uptake	FISH	direct contact	INGESTION	na	na	na	na	na	X	na	na	na	na	na
			recharge to gw	GROUNDWATER see below													
	infiltration / leaching	GROUNDWATER	migration to water wells			INGESTION DERMAL CONTACT INHALATION OF VAPORS	X	X	--	--	--	--	X	--	--	--	--
			migration/discharge	SURFACE WATER Quarry Pond	direct contact volatilization	INCIDENTAL INGESTION DERMAL CONTACT INHALATION OF VAPORS	na	na	na	na	X	X	na	na	na	na	na
			migration/discharge	SURFACE WATER Great Miami River	direct contact volatilization	INCIDENTAL INGESTION DERMAL CONTACT INHALATION OF VAPORS	na	na	na	na	na	na	na	na	na	X	X
			volatilization and subsurface migration	INDOOR AIR	dispersion	INHALATION OF VAPORS	X	X	--	--	--	--	X	--	--	--	--
			volatilization to atmosphere	AMBIENT AIR	dispersion	INHALATION OF VAPORS	X	X	X	X	--	--	X	X	X	X	X
			direct contact			INCIDENTAL INGESTION DERMAL CONTACT INHALATION OF VAPORS	X	X	X	X	--	--	X	X	X	X	X

LEGEND

--	incomplete exposure pathway e.g., due to absence of exposure route and/or receptor
na	not applicable due to spatial separation
[1]	Residential use is evaluated although Respondents intend to put institutional controls, in the form of an envrionmental covenant in place for relevant parts of OU1, which would restrict residential use.
X	potentially complete exposure pathway to be evaluated/addressed as part of OU1
X	pathway to be addressed as part of vapor intrusion studies (and subject to RI findings)
X	potentially complete exposure pathway to be evaluated for areas outside of OU1

figure 2.1

CONCEPTUAL SITE MODEL - HUMAN HEALTH
SOUTH DAYTON DUMP AND LANDFILL SITE
Moraine, Ohio

Table 2.1

Summary of Exposure Assumptions
South Dayton Dump Site
Moraine, Ohio

		Trespasser (adolescent)			Resident (child and adult)			Recreational User (child and adult)			Fish Eater (child and adult)		
Exposure Factor	**Units**	**CTE**	**RME**	**Reference**	**CTE**	**RME**	**Reference**	**CTE**	**RME**	**Reference**	**CTE**	**RME**	**Reference**
Ingestion Rate of Soil/Sediment– Child - IR	mg soil/day	--	--		200	200	U.S. EPA, 2014	200	200	U.S. EPA, 2002	--	--	
Ingestion Rate of Soil/Sediment - Adult – IR	mg soil/day	100	100	U.S. EPA, 2002	100	100	U.S. EPA, 2014	100	100	U.S. EPA, 2002	--	--	
Mutagenic Ingestion Rate of Soil/Sediment – IFSMadj - Age-adjusted	mg-year/kg-day	--	--		438	477	U.S. EPA, 2005a (7)	438	477	U.S. EPA, 2005a (7)	--	--	
Ingestion Rate of Water – Child IR	L water/day	--	--		0.78	0.78	U.S. EPA, 2014	--	--		--	--	
Ingestion Rate of Water Adult – IR	L water/day	--	--		2.5	2.5	U.S. EPA, 2014	--	--		--	--	
Mutagenic Ingestion Rate of Water – IFWMadj - Age-adjusted	L-year/kg-event	--	--		3	1.9	U.S. EPA, 2005a (7)	--	--		--	--	
Ingestion Rate of Surface Water Child – IR	L water/day	--	--		--	--		--	--		--	--	
Ingestion Rate of Surface Water Adult – IR	L water/day	0.124	0.124	U.S. EPA, 2019	--	--		--	--		--	--	
Consumption Rate of Fish – CR Child	kg-meal	--	--		--	--		--	--		0.085	0.085	OEPA, 2019 (14)
Consumption Rate of Fish – CR Adult	kg-meal	--	--		--	--		--	--		0.17	0.17	OEPA, 2019
Mutagenic Consumption Rate of Fish – M CR – Age adjusted	yr/meal	--	--		--	--		--	--		0.27	0.27	U.S. EPA, 2005a (7)
Exposure Frequency – Soil and Groundwater – EF	days/year	29	58	(1)	350	350	U.S. EPA, 2004	70	140	Professional Judgement (17)	--	--	
Exposure Frequency – Sediment and Surface Water – EF	days/year	29	58	(1)	--	--		--	--		--	--	
Exposure Frequency – Fish Consumption – EF	meals/yr	--	--		--	--		--	--		8	8	Professional Judgement
Fraction of Fish Consumed F	unitless	--	--		--	--		--	--		1	1	U.S. EPA, 2005b
Exposure Duration – ED – Child	years	--	--		6	6	U.S. EPA, 2004	6	6	U.S. EPA, 2004	6	6	U.S. EPA, 2004
Exposure Duration – ED - Adult	years	10	10	U.S. EPA, 2014 (2)	3	20	U.S. EPA, 2004/U.S. EPA 2014	3	20	U.S. EPA, 2004/U.S. EPA 2014	3	20	U.S. EPA, 2004/U.S. EPA 2014
Body Weight – BW – Child	kg	--	--		15	15	U.S. EPA, 2002	15	15	U.S. EPA, 2002	15	15	U.S. EPA, 2002
Body Weight – BW - Adult	kg	45	45	U.S. EPA, 2014	80	80	U.S. EPA, 2014	80	80	U.S. EPA, 2014	80	80	U.S. EPA, 2014
Skin Surface Area Available for Contact – soil – SA - Child	cm^2	--	--		2,373	2,373	U.S. EPA, 2014	2,373	2,373	U.S. EPA, 2014	--	--	
Skin Surface Area Available for Contact – soil – SA - Adult	cm^2	5,537	5,537	U.S. EPA, 2011 (3)	6,032	6,032	U.S. EPA, 2014	6,032	6,032	U.S. EPA, 2014	--	--	
Mutagenic Soil Dermal Contact Factor – DFSMadj – Age-adjusted	mg-year/kg	--	--		209	1,224	U.S. EPA, 2005a (7)	209	1,224	U.S. EPA, 2005a (7)	--	--	
Skin Surface Area Available for Contact – Water – SA Child	cm^2	--	--		6,378	6,378	U.S. EPA, 2014	--	--		--	--	
Skin Surface Area Available for Contact – Water – SA Adult	cm^2	5,537	5,537	U.S. EPA, 2011 (3)	20,900	20,900	U.S. EPA, 2014	--	--		--	--	
Mutagenic Water Dermal Contact Factor – DFWMadj – Age adjusted	cm^2-year/kg	--	--		15,958	25,101	U.S. EPA, 2005a (7)	--	--		--	--	
Event Frequency – Dermal – Water – EV	event/day	--	--		1	1	U.S. EPA, 2004	--	--		--	--	
Exposure Time for Dermal Contact – Water – ET Child	hour/event	--	--		0.33	0.54	U.S. EPA, 2014	--	--		--	--	
Exposure Time for Dermal Contact – Water – ET Adult	hour/event	0.5	1	USEPA, 2011 (13)	0.25	0.71	U.S. EPA, 2014	--	--		--	--	
Mutagenic Exposure Time for Dermal Contact – Water – ET Adult	hour/day	--	--		0.3	0.78	U.S. EPA, 2014	--	--		--	--	
Skin Adherence Factor – Soil/Sediment – AF – Child	mg/cm^2	--	--		0.04	0.2	U.S. EPA, 2004	0.04	0.2	U.S. EPA, 2004	--	--	
Skin Adherence Factor – Soil/Sediment – AF - Adult	mg/cm^2	0.04	0.07	U.S. EPA, 2004	0.01	0.07	U.S. EPA, 2004	0.01	0.07	U.S. EPA, 2004	--	--	
Absorption Factor – ABS	%/100	chemical specific	chemical specific	(4)	chemical specific	chemical specific	(4)	chemical specific	chemical specific	(4)	--	--	
Fraction Time Exposed Inhalation - Soil – FT	unitless	1.95/24	3.9/24	U.S. EPA, 2011 (5)	1/24	2/24	U.S. EPA, 2011 (8)	0.5/24	1/24	U.S. EPA, 2011 (13)	--	--	
Fraction Time Exposed – Water - Inhalation – FT	unitless	0.5/24	1/24	USEPA, 2011 (13)	24/24	24/24	U.S. EPA, 2014	--	--		--	--	
Mutagenic Inhalation Factor - IFMadj - Age-adjusted	years	--	--		41	72	U.S. EPA, 2005a (7)	--	--		--	--	
Particulate Emission Factor – PEF	m^3/kg	1.36E+09	1.36E+09	U.S. EPA, 2002	1.36E+09	1.36E+09	U.S. EPA, 2002	--	--		--	--	
Volatilization Factor – Soil - VF	m^3/kg	chemical specific	chemical specific	U.S. EPA, 2002	chemical specific	chemical specific	U.S. EPA, 2002	--	--		--	--	
Volatilization Factor – Water – VF	L/m^3	--	--		0.5	0.5	U.S. EPA, 1991	--	--		--	--	
Averaging Time (cancer) - AT-C	days	25,550	25,550	U.S. EPA, 1989	25,550	25,550	U.S. EPA, 1989	25,550	25,550	U.S. EPA, 1989	25,550	25,550	U.S. EPA, 1989
Averaging Time (non-cancer) - AT-N (ED x 365 days/year) Child	days	--	--		2,190	2,190	U.S. EPA, 1989	2,190	2,190	U.S. EPA, 1989	2,190	2,190	U.S. EPA, 1989
Averaging Time (non-cancer) - AT-N (ED x 365 days/year) Adult	days	3,650	3,650	U.S. EPA, 1989	1,095	7,300	U.S. EPA, 1989	1,095	7,300	U.S. EPA, 1989	1,095	7,300	U.S. EPA, 1989
Mutagenic Factor - MF	unitless	3	3	U.S. EPA, 2005a (6)	--	--		--	--		--	--	
Fraction Absorbed – FA	unitless	--	--		chemical specific	chemical specific	U.S. EPA, 2004	chemical specific	chemical specific	U.S. EPA, 2004	--	--	
Permeability Constant – PC	cm/hour	--	--		chemical specific	chemical specific	U.S. EPA, 2004	chemical specific	chemical specific	U.S. EPA, 2004	--	--	
Lag Time per event – Tevent	hr/event	--	--		chemical specific	chemical specific	U.S. EPA, 2004	chemical specific	chemical specific	U.S. EPA, 2004	--	--	
Constant – B	dimensionless	--	--		chemical specific	chemical specific	U.S. EPA, 2004	chemical specific	chemical specific	U.S. EPA, 2004	--	--	

Table 2.1

Summary of Exposure Assumptions
South Dayton Dump Site
Moraine, Ohio

Notes:

(1) The basis for the EF is the average of the mean time spent outdoors for the age groups 6-11 and 11-16 from Table 16-1, Recommended Values for Activity Factors - Time Outdoors (total). For 6-11 years old, the time spent outdoors of 132 min/day equals an exposure frequency of 33 days/year [(132 min/d /1440 total min/d)*365]. For 11-16 years old, the time spent outdoors of 100 min/day equals an exposure frequency of 25 days/year [(100 min/d /1440 total min/d)*365]. The average of the 6-11 and 11-16 ages groups of 29 days/year is a central tendency value that was doubled to 58 days/year to derive the RME value.

(2) Trespasser is a 7- through 16-year old therefore the exposure duration is 10 years, based on U.S. EPA Region 4 (2014).

(3) The basis for SA is the average value for age groups 6 to 11 and 11 to 16 and calculated by summing the mean surface area by body part for face, lower arms, lower legs, feet, and hands from Table 7-2, Recommended Values for Surface Area of Body Parts, Males and Female Children Combined. The surface area of the face was assumed to be one-third the surface area of the head, the surface area of the lower legs was assumed to be 40 percent of the surface area of the legs, and the surface area of the lower arms was assumed to be 45 percent of the surface area of the arms.

(4) The default oral assumption of 100 percent is applied for all parameters with the exception of arsenic at 60 percent (U.S. EPA, 2012). The dermal absorption values are obtained from Exhibit 3-4 of U.S. EPA, 2004 or Region 3 Technical Guidance Manual, Risk Assessment https://www.epa.gov/risk/assessing-dermal-exposure-soil.

(5) The basis for the ET is the average of the mean time spent outdoors for the age groups 6-11 and 11-16 from Table 16-1, Recommended Values for Activity Factors - Time Outdoors. For 6-11 years old, the time spent outdoors of 132 min/day equates to 2.2 hrs [132/60]. For 11-16 years old, the time spent outdoors of 100 min/day equates to 1.7 hrs [100/60]. The average of the 6-11 and 11-16 ages groups of 1.95 hours is a central tendency value that was doubled to 3.9 hours to derive the RME value.

(6) Mutagenic ingestion, dermal contact, and inhalation intakes calculated using default age-dependent adjustment factor of 3 for ages >2 to 16 years as applied for carcinogens that act via a mutagenic mode of action.

(7) Mutagenic soil ingestion, dermal contact, and inhalation factors calculated using default age-dependent adjustment factor of 10 for ages 0-2 year, 3 for ages >2 to 16 years, and 1 for ages >16 years as applied for carcinogens that act via a mutagenic mode of action.

(8) RME exposure time is based on the 95th percentile playing on sand/gravel or grass of 121 minutes per day (121 minutes per day/60 minutes per hour) (USEPA, 2011, Table 16-1. Recommended Values for Activity Patterns). The CT is half the RME.

(9) An incidental surface water ingestion rate of 50 mL/hour, specified in Risk Assessment Guidance for Superfund Part A (USEPA, 1989), represents the incidental water ingestion rate for an adult while swimming. Because the worker will not be swimming , but instead may have only occasional limited contact, a factor of 10 was applied to arrive at the incidental ingestion rate of 0.005 L/hr.

(10) An exposure frequency of 120 days/year for construction/excavation activities was chosen by Ohio EPA on the basis of best professional judgment (Ohio VAP Part C, p. 41). The CT is half the RME value.

(11) Assumes a construction/utility worker conducts installations and/or repairs/maintenance for 5 days/year for CT and 10 days/year for the RME.

(12) The ET assumes a construction/utility worker is in direct contact with the medium for a limited time (1 hours/day) spent on the Site.

(13) RME exposure time is based on half of the 95th percentile playing on sand/gravel or grass of 121 minutes per day [(121 minutes per day/60 minutes per hour)/2] (U.S. EPA, 2011, Table 16-1. Recommended Values for Activity Patterns). The CTE is half the RME.

(14) Based on half the OEPA recommended fish serving size for an adult (6 oz).

(15) Professional Judgement; based on 1 meal per month for the months of April through to November.

(16) Professional Judgement; based on cutting grass 1 day/week for the months of April through to October. CTE is half the RME value.

(17) Professional Judgement; based on recreational users using the pathway 4 times per week through the months of April to November (35 weeks). CTE is half the RME value.

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Table 2.1

Summary of Exposure Assumptions
South Dayton Dump Site
Moraine, Ohio

		Industrial/Commercial Worker (adult)			Maintenance Worker (adult)			Construction/Utility Worker (adult)		
Exposure Factor	**Units**	**CTE**	**RME**	**Reference**	**CTE**	**RME**	**Reference**	**CTE**	**RME**	**Reference**
Ingestion Rate of Soil/Sediment– Child - IR	mg soil/day	--	--		--	--		--	--	
Ingestion Rate of Soil/Sediment - Adult – IR	mg soil/day	100	100	U.S. EPA, 2014	100	100	U.S. EPA, 2014	330	330	U.S. EPA, 2002
Mutagenic Ingestion Rate of Soil/Sediment – IFSMadj - Age-adjusted	mg-year/kg-day	--	--		--	--		--	--	
Ingestion Rate of Water – Child IR	L water/day	--	--		--	--		--	--	
Ingestion Rate of Water Adult – IR	L water/day	--	--		--	--		0.02	0.02	Virginia DEQ, 2018
Mutagenic Ingestion Rate of Water – IFWMadj - Age-adjusted	L-year/kg-event	--	--		--	--		--	--	
Ingestion Rate of Surface Water Child – IR	L water/day	--	--		--	--		0.005	0.005	U.S. EPA, 1989 (9)
Ingestion Rate of Surface Water Adult – IR	L water/day	--	--		--	--		0.005	0.005	U.S. EPA, 1989 (9)
Consumption Rate of Fish – CR Child	kg-meal	--	--		--	--		--	--	
Consumption Rate of Fish – CR Adult	kg-meal	--	--		--	--		--	--	
Mutagenic Consumption Rate of Fish – M CR – Age adjusted	yr/meal	--	--		--	--		--	--	
Exposure Frequency – Soil and Groundwater – EF	days/year	219	250	U.S. EPA, 2004/U.S. EPA, 2014	17.5	35	Professional Judgement (16)	60	120	Ohio VAP, 2016 (10)
Exposure Frequency – Sediment and Surface Water – EF	days/year	--	--		--	--		5	10	(11)
Exposure Frequency – Fish Consumption – EF	meals/yr	--	--		--	--		--	--	
Fraction of Fish Consumed F	unitless	--	--		--	--		--	--	
Exposure Duration – ED – Child	years	--	--		--	--		--	--	
Exposure Duration – ED - Adult	years	9	25	U.S. EPA, 2004/U.S. EPA, 2014	9	25	U.S. EPA, 2004/U.S. EPA, 2014	1	1	U.S. EPA, 2002
Body Weight – BW – Child	kg	--	--		--	--		--	--	
Body Weight – BW - Adult	kg	80	80	U.S. EPA, 2014	80	80	U.S. EPA, 2014	80	80	U.S. EPA, 2014
Skin Surface Area Available for Contact – soil – SA - Child	cm^2	--	--		--	--		--	--	
Skin Surface Area Available for Contact – soil – SA - Adult	cm^2	3527	3527	U.S. EPA, 2014	3527	3527	U.S. EPA, 2014	3527	3527	U.S. EPA, 2014
Mutagenic Soil Dermal Contact Factor – DFSMadj – Age-adjusted	mg-year/kg	--	--		--	--		--	--	
Skin Surface Area Available for Contact – Water – SA Child	cm^2	--	--		--	--		--	--	
Skin Surface Area Available for Contact – Water – SA Adult	cm^2	--	--		--	--		--	--	
Mutagenic Water Dermal Contact Factor – DFWMadj – Age adjusted	cm^2-year/kg	--	--		--	--		--	--	
Event Frequency – Dermal – Water – EV	event/day	--	--		--	--		1	1	U.S. EPA, 2004
Exposure Time for Dermal Contact – Water – ET Child	hour/event	--	--		--	--		--	--	
Exposure Time for Dermal Contact – Water – ET Adult	hour/event	--	--		--	--		--	--	
Mutagenic Exposure Time for Dermal Contact – Water – ET Adult	hour/day	--	--		--	--		--	--	
Skin Adherence Factor – Soil/Sediment – AF – Child	mg/cm^2	--	--		--	--		--	--	
Skin Adherence Factor – Soil/Sediment – AF - Adult	mg/cm^2	0.02	0.12	U.S. EPA, 2004/U.S. EPA, 2014	0.02	0.12	U.S. EPA, 2004/U.S. EPA, 2014	0.1	0.3	U.S. EPA, 2004
Absorption Factor – ABS	%/100	chemical specific	chemical specific	(4)	chemical specific	chemical specific	(4)	chemical specific	chemical specific	(4)
Fraction Time Exposed Inhalation - Soil – FT	unitless	8/24	8/24	U.S. EPA, 2014	8/24	8/24	U.S. EPA, 2014	8/24	8/24	U.S. EPA, 2014
Fraction Time Exposed – Water - Inhalation – FT	unitless	--	--		--	--		1	1	(12)
Mutagenic Inhalation Factor - IFMadj - Age-adjusted	years	--	--		--	--		--	--	
Particulate Emission Factor – PEF	m^3/kg	1.36E+09	1.36E+09	U.S. EPA, 2002	1.36E+09	1.36E+09	U.S. EPA, 2002	1.34E+07	1.34E+07	Ohio VAP, 2016
Volatilization Factor – Soil - VF	m^3/kg	chemical specific	chemical specific	U.S. EPA, 2002	chemical specific	chemical specific	U.S. EPA, 2002	chemical specific	chemical specific	U.S. EPA, 2002
Volatilization Factor – Water – VF	L/m^3	--	--		--	--		chemical specific	chemical specific	U.S. EPA, 1999
Averaging Time (cancer) - AT-C	days	25550	25550	U.S. EPA, 1989	25550	25550	U.S. EPA, 1989	25550	25550	U.S. EPA, 1989
Averaging Time (non-cancer) - AT-N (ED x 365 days/year) Child	days	--	--		--	--		--	--	
Averaging Time (non-cancer) - AT-N (ED x 365 days/year) Adult	days	3285	9125	U.S. EPA, 1989	3285	9125	U.S. EPA, 1989	365	365	U.S. EPA, 1989
Mutagenic Factor - MF	unitless	--	--		--	--		--	--	
Fraction Absorbed – FA	unitless	--	--		--	--		chemical specific	chemical specific	U.S. EPA, 2004
Permeability Constant – PC	cm/hour	--	--		--	--		chemical specific	chemical specific	U.S. EPA, 2004
Lag Time per event – Tevent	hr/event	--	--		--	--		chemical specific	chemical specific	U.S. EPA, 2004
Constant – B	dimensionless	--	--		--	--		chemical specific	chemical specific	U.S. EPA, 2004

Table 2.1

Summary of Exposure Assumptions
South Dayton Dump Site
Moraine, Ohio

Notes:

(1) The basis for the EF is the average of the mean time spent outdoors for the age groups 6-11 and 11-16 from Table 16-1, Recommended Values for Activity Factors - Time Outdoors (total). For 6-11 years old, the time spent outdoors of 132 min/day equals an exposure frequency of 33 days/year [(132 min/d /1440 total min/d)*365]. For 11-16 years old, the time spent outdoors of 100 min/day equals an exposure frequency of 25 days/year [(100 min/d /1440 total min/d)*365]. The average of the 6-11 and 11-16 ages groups of 29 days/year is a central tendency value that was doubled to 58 days/year to derive the RME value.

(2) Trespasser is a 7- through 16-year old therefore the exposure duration is 10 years, based on U.S. EPA Region 4 (2014).

(3) The basis for SA is the average value for age groups 6 to 11 and 11 to 16 and calculated by summing the mean surface area by body part for face, lower arms, lower legs, feet, and hands from Table 7-2, Recommended Values for Surface Area of Body Parts, Males and Female Children Combined. The surface area of the face was assumed to be one-third the surface area of the head, the surface area of the lower legs was assumed to be 40 percent of the surface area of the legs, and the surface area of the lower arms was assumed to be 45 percent of the surface area of the arms.

(4) The default oral assumption of 100 percent is applied for all parameters with the exception of arsenic at 60 percent (U.S. EPA, 2012). The dermal absorption values are obtained from Exhibit 3-4 of U.S. EPA, 2004 or Region 3 Technical Guidance Manual, Risk Assessment https://www.epa.gov/risk/assessing-dermal-exposure-soil.

(5) The basis for the ET is the average of the mean time spent outdoors for the age groups 6-11 and 11-16 from Table 16-1, Recommended Values for Activity Factors - Time Outdoors. For 6-11 years old, the time spent outdoors of 132 min/day equates to 2.2 hrs [132/60]. For 11-16 years old, the time spent outdoors of 100 min/day equates to 1.7 hrs [100/60]. The average of the 6-11 and 11-16 ages groups of 1.95 hours is a central tendency value that was doubled to 3.9 hours to derive the RME value.

(6) Mutagenic ingestion, dermal contact, and inhalation intakes calculated using default age-dependent adjustment factor of 3 for ages >2 to 16 years as applied for carcinogens that act via a mutagenic mode of action.

(7) Mutagenic soil ingestion, dermal contact, and inhalation factors calculated using default age-dependent adjustment factor of 10 for ages 0-2 year, 3 for ages >2 to 16 years, and 1 for ages >16 years as applied for carcinogens that act via a mutagenic mode of action.

(8) RME exposure time is based on the 95th percentile playing on sand/gravel or grass of 121 minutes per day (121 minutes per day/60 minutes per hour) (USEPA, 2011, Table 16-1. Recommended Values for Activity Patterns). The CT is half the RME.

(9) An incidental surface water ingestion rate of 50 mL/hour, specified in Risk Assessment Guidance for Superfund Part A (USEPA, 1989), represents the incidental water ingestion rate for an adult while swimming. Because the worker will not be swimming , but instead may have only occasional limited contact, a factor of 10 was applied to arrive at the incidental ingestion rate of 0.005 L/hr.

(10) An exposure frequency of 120 days/year for construction/excavation activities was chosen by Ohio EPA on the basis of best professional judgment (Ohio VAP Part C, p. 41). The CT is half the RME value.

(11) Assumes a construction/utility worker conducts installations and/or repairs/maintenance for 5 days/year for CT and 10 days/year for the RME.

(12) The ET assumes a construction/utility worker is in direct contact with the medium for a limited time (1 hours/day) spent on the Site.

(13) RME exposure time is based on half of the 95th percentile playing on sand/gravel or grass of 121 minutes per day [(121 minutes per day/60 minutes per hour)/2] (U.S. EPA, 2011, Table 161. Recommended Values for Activity Patterns). The CTE is half the RME.

(14) Based on half the OEPA recommended fish serving size for an adult (6 oz).

(15) Professional Judgement; based on 1 meal per month for the months of April through to November.

(16) Professional Judgement; based on cutting grass 1 day/week for the months of April through to October. CTE is half the RME value.

(17) Professional Judgement; based on recreational users using the pathway 4 times per week through the months of April to November (35 weeks). CTE is half the RME value.

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Appendices

Appendix A
Risk Assessment Tables
(RAGS Part D Format)

Table 1

HHRA Conceptual Site Model
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium	Exposure Medium	Exposure Point	Scenario Timeframe	Receptor Population	Receptor Age	Exposure Route	On-Site/ Off-Site	Type of Analysis	Rationale for Selection or Exclusion of Exposure Pathway
Surface Soil (0-2 ftbgs)	Surface Soil	Direct Contact	Current/ Future	Trespasser	Adolescent	Ingestion Dermal Inhalation of Particulates/Volatiles	on-Site	Quantitative	Potential exposure to contaminated surface soil while trespassing.
			Current	Resident	Child & Adult	Ingestion Dermal Inhalation of Particulates/Volatiles			Potential exposure to contaminated surface soil.
				Industrial/ Commercial Worker	Adult	Ingestion Dermal Inhalation of Particulates/Volatiles			Potential exposure to contaminated surface soil.
Soil (0 - 15 ftbgs)	Surface and Subsurface Soil		Future	Resident	Child & Adult	Ingestion Dermal Inhalation of Particulates/Volatiles			Potential exposure to contaminated surface soil.
				Industrial/ Commercial Worker	Adult	Ingestion Dermal Inhalation of Particulates/Volatiles			Potential exposure to contaminated subsurface soil.
				Construction/Utility Worker	Adult	Ingestion Dermal Inhalation of Particulates/Volatiles			Potential exposure to contaminated subsurface soil during ground intrusive activities.
Groundwater	Groundwater		Current/ Future	Resident	Child & Adult	Ingestion Dermal Inhalation of Volatiles			Potential exposure to contaminated tapwater.
			Future	Construction/Utility Worker	Adult	Ingestion Dermal Inhalation of Volatiles			Potential exposure to contaminated groundwater during ground intrusive activities.
	Indoor Air		Current/ Future	Resident	Child & Adult	Inhalation of Volatiles			Potential exposure to contaminated groundwater volatilizing to indoor air.
				Industrial/ Commercial Worker	Adult	Inhalation of Volatiles			Potential exposure to contaminated groundwater volatilizing to indoor air.
Quarry Pond Sediment	Sediment		Current/ Future	Recreational User	Child & Adult	Ingestion Dermal			Potential exposure to contaminated sediment while wading.
			Future	Construction/Utility Worker	Adult	Ingestion Dermal			Potential exposure to contaminated sediment during ground intrusive activities.
	Fish		Current/ Future	Angler	Child & Adult	Ingestion			Potential exposure to contaminated fish.
Quarry Pond Surface Water	Surface Water		Current/ Future	Recreational User	Child & Adult	Ingestion Dermal Inhalation of Volatiles			Potential exposure to contaminated surface water while wading.
				Construction/Utility Worker	Adult	Ingestion Dermal Inhalation of Volatiles			Potential exposure to contaminated surface water during ground intrusive activities.
	Fish		Current/ Future	Fish Eater	Child & Adult	Ingestion			Potential exposure to contaminated fish.

Table 2.1

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU01 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/9	0.31 - 4.7	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/9	0.35 - 4.7	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/9	0.53 - 4.7	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/9	0.45 - 4.7	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/9	0.73 - 4.7	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/9	0.32 - 4.7	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/9	0.92 - 9.4	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/9	0.47 - 4.7	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/9	0.3 - 4.7	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/9	0.39 - 4.7	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/9	0.42 - 4.7	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/9	0.39 - 4.7	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/9	0.47 - 4.7	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	4.7 J	4.7 J	µg/kg	TT-16: 2 ft BGS (9/30/2008)	1/9	1.7 - 5	4.7 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/9	0.78 - 19	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/9	1.2 - 19	N/A	3300000	N	N	ND
67-64-1	Acetone	13 J	13 J	µg/kg	TT-16: 2 ft BGS (9/30/2008)	1/9	4.1 - 30	13 J	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/9	0.43 - 4.7	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/9	0.45 - 4.7	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/9	0.54 - 4.7	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/9	0.8 - 4.7	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/9	0.28 - 4.7	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/9	0.34 - 4.7	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/9	0.45 - 4.7	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/9	0.51 - 4.7	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/9	0.31 - 4.7	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/9	0.51 - 4.7	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/9	0.38 - 4.7	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/9	0.35 - 4.7	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/9	0.28 - 9.4	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/9	0.41 - 4.7	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/9	0.47 - 4.7	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/9	0.37 - 4.7	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/9	0.27 - 4.7	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/9	1.6 - 9.4	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/9	0.31 - 9.4	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/9	0.37 - 19	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/9	0.32 - 17	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/9	0.37 - 4.7	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/9	0.5 - 4.7	N/A	8100	N	N	ND
108-88-3	Toluene	ND	ND	µg/kg	--	0/9	0.46 - 4.7	N/A	490000	N	N	ND
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/9	0.38 - 4.7	N/A	160000	N	N	ND

Table 2.1

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU01 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/9	0.28 - 4.7	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/9	0.52 - 4.7	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/9	0.32 - 4.7	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/9	0.66 - 4.7	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/9	0.38 - 4.7	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/9	0.54 - 9.4	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/9	11 - 240	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/9	34 - 360	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/9	12 - 360	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/9	27 - 360	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/9	27 - 360	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/9	29 - 790	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/9	23 - 480	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/9	29 - 480	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/9	0.62 - 120	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/9	11 - 120	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	12 J	85	µg/kg	SS-44: 0.08-1 ft BGS (11/27/2018)	8/9	16	85	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/9	15 - 480	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/9	12 - 480	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/9	11 - 120	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/8	27 - 140	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/9	25 - 240	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/9	22 - 480	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/1	480	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/9	13 - 400	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/9	16 - 120	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/9	29 - 360	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/9	23 - 360	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/9	16 - 120	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/9	36 - 480	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/9	23 - 790	N/A	--		N	ND
83-32-9	Acenaphthene	12 J	130	µg/kg	SS-45: 0.17-1.5 ft BGS (11/27/2018)	6/9	3.3 - 14	130	360000	N	N	BSV
208-96-8	Acenaphthylene	12 J	320	µg/kg	SS-37: 0-2 ft BGS (11/20/2018)	9/9	--	320	360000 (5)	N	N	BSV
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/9	13 - 240	N/A	780000	N	N	ND
120-12-7	Anthracene	25	540	µg/kg	SS-37: 0-2 ft BGS (11/20/2018)	9/9	--	540	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/9	12 - 480	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	16 J	16 J	µg/kg	SS-39: 0-2 ft BGS (11/1/2017)	1/9	26 - 240	16 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**210**	**3400**	**µg/kg**	**SS-37: 0-2 ft BGS (11/20/2018)**	**9/9**	**--**	**3400**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**190**	**3100**	**µg/kg**	**SS-37: 0-2 ft BGS (11/20/2018)**	**9/9**	**--**	**3100**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**280**	**3900**	**µg/kg**	**SS-37: 0-2 ft BGS (11/20/2018)**	**9/9**	**--**	**3900**	**1100**	**C**	**Y**	**ASV**

Table 2.1

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU01 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	160	2400	µg/kg	SS-37: 0-2 ft BGS (11/20/2018)	9/9	--	2400	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	120	1500	µg/kg	SS-37: 0-2 ft BGS (11/20/2018)	9/9	--	1500	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	10 J	11 J	µg/kg	SS-39: 0-2 ft BGS (11/1/2017)	1/9	19 - 120	11 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/9	14 - 240	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/9	2.7 - 240	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	78 J	330	µg/kg	SS-40: 0-2 ft BGS (11/20/2018)	3/9	59 - 220	330	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/9	14 - 120	N/A	290000	C	N	ND
105-60-2	Caprolactam	320 J	320 J	µg/kg	SS-39: 0-2 ft BGS (11/1/2017)	1/9	51 - 790	320 J	3100000	N	N	BSV
86-74-8	**Carbazole**	**26 J**	**330**	**µg/kg**	**SS-40: 0-2 ft BGS (11/20/2018)**	**7/9**	**22 - 84**	**330**	**--**		**Y**	**AD**
218-01-9	Chrysene	210	3200	µg/kg	SS-37: 0-2 ft BGS (11/20/2018)	9/9	--	3200	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**30**	**570**	**µg/kg**	**SS-37: 0-2 ft BGS (11/20/2018)**	**7/9**	**8 - 30**	**570**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	18 J	67 J	µg/kg	SS-40: 0-2 ft BGS (11/20/2018)	5/9	15 - 120	67 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/9	22 - 150	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/9	16 - 120	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/kg	--	0/9	21 - 120	N/A	630000	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/9	11 - 140	N/A	63000	N	N	ND
206-44-0	Fluoranthene	270	4800	µg/kg	SS-37: 0-2 ft BGS (11/20/2018)	9/9	--	4800	240000	N	N	BSV
86-73-7	Fluorene	13 J	120	µg/kg	SS-40: 0-2 ft BGS (11/20/2018)	7/9	3.1 - 12	120	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/9	2.9 - 16	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/9	7.7 - 120	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/8	11 - 790	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/9	10 - 120	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**130**	**1900**	**µg/kg**	**SS-37: 0-2 ft BGS (11/20/2018)**	**9/9**	**--**	**1900**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/9	14 - 120	N/A	570000	C	N	ND
91-20-3	Naphthalene	12 J	63 J	µg/kg	SS-37: 0-2 ft BGS (11/20/2018)	8/9	16	63 J	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/9	3 - 240	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/9	8.6 - 120	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/9	14 - 120	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/9	12 - 360	N/A	1000	C	N	ND
85-01-8	Phenanthrene	67	2000	µg/kg	SS-40: 0-2 ft BGS (11/20/2018)	9/9	--	2000	180000 (5)	N	N	BSV
108-95-2	Phenol	13 J	13 J	µg/kg	SS-39: 0-2 ft BGS (11/1/2017)	1/9	9.1 - 120	13 J	1900000	N	N	BSV
129-00-0	Pyrene	270	5200	µg/kg	SS-37: 0-2 ft BGS (11/20/2018)	9/9	--	5200	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**3000**	**8400 J**	**mg/kg**	**SS-39: 0-2 ft BGS (11/1/2017)**	**9/9**	**--**	**8400 J**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.14 J	0.84 J	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	8/9	7.2	0.84 J	3.1	N	N	BSV
7440-38-2	**Arsenic**	**3.6**	**29**	**mg/kg**	**SS-39: 0-2 ft BGS (11/1/2017)**	**9/9**	**--**	**29**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	42	170 J	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	9/9	--	170 J	1500	N	N	BSV
7440-41-7	Beryllium	0.24 J	2.5	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	9/9	--	2.5	16	N	N	BSV
7440-43-9	Cadmium	0.23	2.2	mg/kg	SS-37: 0-2 ft BGS (11/20/2018)	9/9	--	2.2	7.1	N	N	BSV
7440-70-2	Calcium	45000	190000	mg/kg	SS-44: 0.08-1 ft BGS (11/27/2018)	9/9	--	190000	--		N	NAT
16065-83-1	Chromium III (trivalent)	6.7	14	mg/kg	SS-42: 0-0.67 ft BGS (11/27/2018)	9/9	--	14	12000	N	N	BSV

Table 2.1

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU01 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.31 J**	**2.3**	**mg/kg**	**SS-39: 0-2 ft BGS (11/1/2017)**	**4/9**	**0.27 - 1.5**	**2.3**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**2.7**	**9.6**	**mg/kg**	**SS-39: 0-2 ft BGS (11/1/2017)**	**9/9**	**--**	**9.6**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	12.6	44	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	9/9	--	44	310	N	N	BSV
57-12-5	Cyanide (total)	ND	ND	mg/kg	--	0/9	0.21 - 0.64	N/A	2.3	N	N	ND
7439-89-6	**Iron**	**7000**	**16000**	**mg/kg**	**SS-37: 0-2 ft BGS (11/20/2018)**	**9/9**	**--**	**16000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	18.4 J	51 J	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	9/9	--	51 J	400	C	N	BSV
7439-92-1	Lead - coarse fraction	24	62	mg/kg	SS-44: 0.08-1 ft BGS (11/27/2018)	2/2	--	62	400	C	N	BSV
7439-92-1	Lead - fine fraction	48	100	mg/kg	SS-44: 0.08-1 ft BGS (11/27/2018)	2/2	--	100	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	26	70	mg/kg	SS-44: 0.08-1 ft BGS (11/27/2018)	2/2	--	70	400	C	N	BSV
7439-95-4	Magnesium	18000	47000	mg/kg	SS-38: 0-2 ft BGS (11/20/2018)	9/9	--	47000	--		N	NAT
7439-96-5	**Manganese**	**270**	**624 J**	**mg/kg**	**TT-16: 2- ft BGS (9/30/2008)**	**9/9**	**--**	**624 J**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.035 J	0.27	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	9/9	--	0.27	1.1	N	N	BSV
7440-02-0	Nickel	7.7 J	25 J	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	9/9	--	25 J	150	N	N	BSV
7440-09-7	Potassium	450 J	1200	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	9/9	--	1200	--		N	NAT
7782-49-2	Selenium	0.60 J	3.7	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	8/9	30	3.7	39	N	N	BSV
7440-22-4	Silver	0.024 J	0.089 J	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	8/9	1.2	0.089 J	39	N	N	BSV
7440-23-5	Sodium	72 J	162 J	mg/kg	TT-16: 2- ft BGS (9/30/2008)	8/9	160 - 180	162 J	--		N	NAT
7440-28-0	**Thallium**	**0.12 J**	**0.82**	**mg/kg**	**SS-39: 0-2 ft BGS (11/1/2017)**	**8/9**	**0.14**	**0.82**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	12	37	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	9/9	--	37	39	N	N	BSV
7440-66-6	Zinc	42	77	mg/kg	SS-39: 0-2 ft BGS (11/1/2017)	9/9	--	77	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/9	24 - 40	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/9	26 - 40	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/9	21 - 40	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/9	21 - 40	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/9	22 - 40	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**33 J**	**180**	**µg/kg**	**SS-42: 0-0.67 ft BGS (11/27/2018)**	**2/9**	**18 - 40**	**180**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	24 J	24 J	µg/kg	SS-39: 0-2 ft BGS (11/1/2017)	1/9	24 - 40	24 J	240	C	N	BSV
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/9	1.6 - 100	N/A	190	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/9	1.6 - 100	N/A	2000	C	N	ND
50-29-3	4,4'-DDT	1.2 NJ	1.2 NJ	µg/kg	SS-44: 0.08-1 ft BGS (11/27/2018)	1/9	1.2 - 100	1.2 NJ	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/9	0.84 - 100	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/9	0.99 - 100	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	3.1 J	32	µg/kg	SS-45: 0.17-1.5 ft BGS (11/27/2018)	4/9	1.6 - 100	32	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/9	1.9 - 100	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/9	1.8 - 100	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/9	1.2 - 100	N/A	34	C	N	ND
959-98-8	Endosulfan I	2.1 NJ	2.1 NJ	µg/kg	SS-40: 0-2 ft BGS (11/20/2018)	1/9	1.3 - 100	2.1 NJ	47000	N	N	BSV
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/9	1.6 - 100	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/9	1.4 - 100	N/A	38000	N	N	ND

Table 2.1

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU01 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/9	2.1 - 100	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	2.1 J	2.1 J	µg/kg	SS-40: 0-2 ft BGS (11/20/2018)	1/9	1.4 - 100	2.1 J	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/9	0.97 - 100	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/9	2 - 100	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	1.9 J	27 J	µg/kg	SS-45: 0.17-1.5 ft BGS (11/27/2018)	4/9	1.3 - 100	27 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/9	1.7 - 100	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	3.8 J	3.8 J	µg/kg	SS-37: 0-2 ft BGS (11/20/2018)	1/9	1.6 - 100	3.8 J	70	C	N	BSV
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/9	7.2 - 200	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/9	27 - 4000	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/3	15 - 17	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/4	16 - 24	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/4	55 - 96	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/3	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-37, SS-38, SS-39, SS-40, SS-41, SS-42, SS-43, SS-44, SS-45, SS-122, SS-124, SS-153-AS, SS-154-AS, SS-155-AS, TT-16.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.2

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU02 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/5	0.76 - 0.88	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/5	1.3 - 1.5	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/5	1.1 - 1.2	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/5	0.65 - 0.75	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/5	0.84 - 0.97	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/5	0.53 - 0.62	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/5	3.4 - 3.9	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/5	0.72 - 0.83	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/5	1 - 1.2	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/5	0.72 - 0.83	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/5	0.79 - 0.92	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/5	0.76 - 0.88	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/5	0.82 - 0.95	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ND	ND	µg/kg	--	0/5	3.3 - 3.8	N/A	2700000	N	N	ND
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/5	3.8 - 4.4	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/5	3.5 - 4	N/A	3300000	N	N	ND
67-64-1	Acetone	ND	ND	µg/kg	--	0/5	20 - 23	N/A	6100000	N	N	ND
71-43-2	Benzene	ND	ND	µg/kg	--	0/5	0.65 - 0.75	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/5	0.63 - 0.73	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/5	2.2 - 2.6	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/5	0.92 - 1.1	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/5	1.1 - 1.3	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/5	3 - 3.5	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/5	0.85 - 0.99	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/5	1.1 - 1.3	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/5	0.73 - 0.85	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/5	0.97 - 1.1	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/5	0.61 - 0.7	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/5	1.3 - 1.5	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/5	1.3 - 1.5	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/5	2.6 - 3	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/5	0.88 - 1	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/5	0.98 - 1.1	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/5	0.78 - 0.9	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/5	3.2 - 3.7	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/5	1.1 - 1.3	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/5	0.76 - 0.88	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/5	11 - 13	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/5	1.1 - 1.2	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/5	0.68 - 0.79	N/A	8100	N	N	ND
108-88-3	Toluene	ND	ND	µg/kg	--	0/5	0.72 - 0.83	N/A	490000	N	N	ND
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/5	0.43 - 0.5	N/A	160000	N	N	ND

Table 2.2

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU02 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/5	0.96 - 1.1	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/5	0.59 - 0.68	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/5	1 - 1.2	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/5	1.2 - 1.4	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/5	0.78 - 0.9	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/5	1.5 - 1.7	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/5	12 - 13	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/5	81 - 88	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/5	75 - 82	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/5	51 - 56	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/5	47 - 51	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/5	170 - 180	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/5	72 - 79	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/5	65 - 72	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/5	16 - 18	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/5	12 - 13	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	ND	ND	µg/kg	--	0/5	2.3 - 2.5	N/A	240000	N	N	ND
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/5	36 - 40	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/5	47 - 51	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/5	15 - 17	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/5	34 - 37	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/5	50 - 55	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/5	57 - 63	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/5	93 - 100	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/5	16 - 18	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/5	53 - 58	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/5	35 - 38	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/5	16 - 18	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/5	70 - 77	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/5	110 - 120	N/A	--		N	ND
83-32-9	Acenaphthene	ND	ND	µg/kg	--	0/5	3.3 - 3.7	N/A	360000	N	N	ND
208-96-8	Acenaphthylene	ND	ND	µg/kg	--	0/5	4.7 - 5.1	N/A	360000 (5)	N	N	ND
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/5	13 - 14	N/A	780000	N	N	ND
120-12-7	Anthracene	ND	ND	µg/kg	--	0/5	2.8 - 3.1	N/A	1800000	N	N	ND
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/5	42 - 46	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/kg	--	0/5	27 - 29	N/A	170000	N	N	ND
56-55-3	Benzo(a)anthracene	9.6 J	17 J	µg/kg	SS-17: 0-2 ft BGS (11/20/2018)	3/5	4.1 - 4.2	17 J	1100	C	N	BSV
50-32-8	Benzo(a)pyrene	12 J	22	µg/kg	SS-17: 0-2 ft BGS (11/20/2018)	3/5	11	22	110	C	N	BSV
205-99-2	Benzo(b)fluoranthene	8.8 J	28	µg/kg	SS-17: 0-2 ft BGS (11/20/2018)	4/5	7.7	28	1100	C	N	BSV

Table 2.2

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU02 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	8.7 J	15 J	µg/kg	SS-15: 0-2 ft BGS (11/20/2018)	3/5	8.5 - 8.7	15 J	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	11 J	11 J	µg/kg	SS-17: 0-2 ft BGS (11/20/2018)	1/5	8.1 - 8.9	11 J	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/kg	--	0/5	20 - 22	N/A	4700	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/5	14 - 15	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/5	14 - 15	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ND	ND	µg/kg	--	0/5	60 - 65	N/A	39000	C	N	ND
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/5	26 - 28	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/5	88 - 96	N/A	3100000	N	N	ND
86-74-8	Carbazole	ND	ND	µg/kg	--	0/5	22 - 24	N/A	--		N	ND
218-01-9	Chrysene	17 J	20	µg/kg	SS-17: 0-2 ft BGS (11/20/2018)	3/5	1.8	20	110000	C	N	BSV
53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/kg	--	0/5	8.1 - 8.9	N/A	110	C	N	ND
132-64-9	Dibenzofuran	ND	ND	µg/kg	--	0/5	15 - 17	N/A	7300	N	N	ND
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/5	36 - 40	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/5	16 - 18	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/kg	--	0/5	26 - 28	N/A	630000	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/5	33 - 36	N/A	63000	N	N	ND
206-44-0	Fluoranthene	9.8 J	40	µg/kg	SS-17: 0-2 ft BGS (11/20/2018)	5/5	--	40	240000	N	N	BSV
86-73-7	Fluorene	ND	ND	µg/kg	--	0/5	3.2 - 3.5	N/A	240000	N	N	ND
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/5	3.3 - 3.7	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/5	14 - 15	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/5	72 - 79	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/5	11 - 12	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	8.8 J	8.8 J	µg/kg	SS-17: 0-2 ft BGS (11/20/2018)	1/5	8.6 - 9.4	8.8 J	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/5	14 - 15	N/A	570000	C	N	ND
91-20-3	Naphthalene	ND	ND	µg/kg	--	0/5	2.8 - 3.1	N/A	3800	C	N	ND
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/5	15 - 17	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/5	13 - 14	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/5	14 - 15	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/5	68 - 74	N/A	1000	C	N	ND
85-01-8	Phenanthrene	4.4 J	21	µg/kg	SS-17: 0-2 ft BGS (11/20/2018)	4/5	2.7	21	180000 (5)	N	N	BSV
108-95-2	Phenol	14 J	14 J	µg/kg	SS-18: 0-2 ft BGS (11/20/2018)	1/5	9.3 - 10	14 J	1900000	N	N	BSV
129-00-0	Pyrene	9.1 J	34	µg/kg	SS-17: 0-2 ft BGS (11/20/2018)	5/5	--	34	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**12000**	**17000**	**mg/kg**	**SS-15: 0-2 ft BGS (11/20/2018)**	**5/5**	**--**	**17000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.27 J	1.5	mg/kg	SS-14: 0-2 ft BGS (11/20/2018)	5/5	--	1.5	3.1	N	N	BSV
7440-38-2	**Arsenic**	**8.3**	**14**	**mg/kg**	**SS-17: 0-2 ft BGS (11/20/2018)**	**5/5**	**--**	**14**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	90	180	mg/kg	SS-16: 0-2 ft BGS (11/20/2018)	5/5	--	180	1500	N	N	BSV
7440-41-7	Beryllium	0.51	0.67	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	0.67	16	N	N	BSV
7440-43-9	Cadmium	0.19 J	0.35	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	0.35	7.1	N	N	BSV
7440-70-2	Calcium	3600	32000	mg/kg	SS-16: 0-2 ft BGS (11/20/2018)	5/5	--	32000	--		N	NAT
16065-83-1	Chromium III (trivalent)	18	24	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	24	12000	N	N	BSV

Table 2.2

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU02 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	Chromium VI (hexavalent)	0.29 J	0.29 J	mg/kg	SS-14: 0-2 ft BGS (11/20/2018)	1/5	0.56 - 0.62	0.29 J	0.3	C	N	BSV
7440-48-4	**Cobalt**	**7.5**	**8.4**	**mg/kg**	**SS-17: 0-2 ft BGS (11/20/2018)**	**5/5**	**--**	**8.4**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	16	26	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	26	310	N	N	BSV
57-12-5	Cyanide (total)	ND	ND	mg/kg	--	0/5	0.21 - 0.26	N/A	2.3	N	N	ND
7439-89-6	**Iron**	**20000**	**26000**	**mg/kg**	**SS-15: 0-2 ft BGS (11/20/2018)**	**5/5**	**--**	**26000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	15	30	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	30	400	C	N	BSV
7439-92-1	Lead - coarse fraction	17 J	17 J	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	1/1	--	17 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	25	25	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	1/1	--	25	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	18	18	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	1/1	--	18	400	C	N	BSV
7439-95-4	Magnesium	3300	17000	mg/kg	SS-16: 0-2 ft BGS (11/20/2018)	5/5	--	17000	--		N	NAT
7439-96-5	**Manganese**	**580**	**730**	**mg/kg**	**SS-14: 0-2 ft BGS (11/20/2018)**	**5/5**	**--**	**730**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.035 J	0.067 J	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	0.067 J	1.1	N	N	BSV
7440-02-0	Nickel	19	23	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	23	150	N	N	BSV
7440-09-7	Potassium	1100	1900	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	1900	--		N	NAT
7782-49-2	Selenium	1.1	1.6	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	1.6	39	N	N	BSV
7440-22-4	Silver	0.038 J	0.12 J	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	0.12 J	39	N	N	BSV
7440-23-5	Sodium	64 J	64 J	mg/kg	SS-16: 0-2 ft BGS (11/20/2018)	1/5	57 - 60	64 J	--		N	NAT
7440-28-0	**Thallium**	**0.20 J**	**0.26**	**mg/kg**	**SS-15: 0-2 ft BGS (11/20/2018)**	**5/5**	**--**	**0.26**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**33**	**43**	**mg/kg**	**SS-15: 0-2 ft BGS (11/20/2018)**	**5/5**	**--**	**43**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	55	110	mg/kg	SS-15: 0-2 ft BGS (11/20/2018)	5/5	--	110	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/5	25 - 28	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/5	28 - 30	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/5	26 - 29	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/5	22 - 24	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/5	28 - 30	N/A	230	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	ND	ND	µg/kg	--	0/5	26 - 29	N/A	120	C	N	ND
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/5	25 - 28	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/5	1.7 - 8.6	N/A	190	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/5	1.8 - 8.8	N/A	2000	C	N	ND
50-29-3	4,4'-DDT	3.5 J	3.5 J	µg/kg	SS-15: 0-2 ft BGS (11/20/2018)	1/5	1.3 - 6.6	3.5 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/5	0.9 - 4.5	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/5	1.1 - 5.3	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/5	1.8 - 8.7	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/5	2 - 10	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/5	2 - 9.8	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/5	1.3 - 6.4	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/5	1.4 - 7	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/5	1.7 - 8.6	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/5	1.5 - 7.4	N/A	38000	N	N	ND

Table 2.2

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU02 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/5	2.2 - 11	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/5	1.5 - 7.6	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/5	1 - 5.2	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/5	2.1 - 10	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/5	1.4 - 7.1	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/5	1.9 - 9.2	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/5	1.7 - 8.4	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/5	7.7 - 38	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/5	29 - 150	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/2	15	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/2	16	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/2	56 - 58	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/2	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-14, SS-15, SS-16, SS-17, SS-18, SS-148, SS-152, SS-156-AS, SS-157-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.3

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/6	0.18 - 0.78	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/6	0.21 - 1.4	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/6	0.31 - 1.1	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/6	0.26 - 0.66	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/6	0.43 - 0.86	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/6	0.19 - 0.54	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/6	0.54 - 3.4	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/6	0.28 - 0.73	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/6	0.18 - 1.1	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/6	0.23 - 0.73	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/6	0.25 - 0.81	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/6	0.23 - 0.77	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/6	0.28 - 0.84	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	5.4 J	13 J	µg/kg	SS-150: 0-2 ft BGS (5/29/2018)	6/6	--	13 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/6	0.46 - 3.9	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/6	0.71 - 3.5	N/A	3300000	N	N	ND
67-64-1	Acetone	22	63	µg/kg	SS-150: 0-2 ft BGS (5/29/2018)	6/6	--	63	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/6	0.26 - 0.66	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/6	0.26 - 0.64	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/6	0.32 - 2.3	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/6	0.47 - 0.94	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/6	0.17 - 1.1	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/6	0.2 - 3.1	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/6	0.26 - 0.87	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/6	0.3 - 1.2	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/6	0.18 - 0.75	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/6	0.3 - 0.99	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.47 J	0.47 J	µg/kg	SS-153: 0-2 ft BGS (5/17/2018)	1/6	0.23 - 0.62	0.47 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/6	0.21 - 1.4	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/6	0.17 - 1.3	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/6	0.24 - 2.6	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/6	0.28 - 0.89	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/6	0.22 - 0.99	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/6	0.16 - 0.79	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/6	0.93 - 3.2	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/6	0.18 - 1.2	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/6	0.22 - 0.78	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/6	0.19 - 11	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/6	0.22 - 1.1	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/6	0.3 - 0.69	N/A	8100	N	N	ND
108-88-3	Toluene	ND	ND	µg/kg	--	0/6	0.27 - 0.73	N/A	490000	N	N	ND
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/6	0.3 - 0.44	N/A	160000	N	N	ND

Table 2.3

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/6	0.17 - 0.98	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/6	0.33 - 0.6	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/6	0.19 - 1	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/6	0.39 - 1.2	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/6	0.22 - 0.79	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/6	0.32 - 1.5	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/6	11 - 4400	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/6	78 - 30000	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/6	72 - 28000	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/6	49 - 19000	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/6	45 - 18000	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/5	160 - 63000	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/6	70 - 27000	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/6	63 - 25000	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/6	16 - 6200	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/6	11 - 4400	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	8.1	6300	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	5/6	0.56	6300	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/6	35 - 14000	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/6	45 - 18000	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/6	15 - 5700	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/6	33 - 13000	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/6	48 - 19000	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/6	55 - 22000	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/0	--	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/5	90 - 35000	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/6	16 - 6200	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/6	51 - 20000	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/6	34 - 13000	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/6	16 - 6200	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/6	67 - 26000	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/6	110 - 42000	N/A	--		N	ND
83-32-9	Acenaphthene	5.0 J	54000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	4/6	0.85 - 8	54000	360000	N	N	BSV
208-96-8	Acenaphthylene	6.1 J	79	µg/kg	SS-149: 0-2 ft BGS (5/29/2018)	3/6	0.39 - 150	79	360000 (5)	N	N	BSV
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/6	12 - 4900	N/A	780000	N	N	ND
120-12-7	Anthracene	11	120000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	6/6	--	120000	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/6	40 - 16000	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/kg	--	0/6	26 - 10000	N/A	170000	N	N	ND
56-55-3	**Benzo(a)anthracene**	**49**	**260000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**260000**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**43**	**270000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**270000**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**67**	**330000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**330000**	**1100**	**C**	**Y**	**ASV**

Table 2.3

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	41	120000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	6/6	--	120000	180000 (5)	N	N	BSV
207-08-9	**Benzo(k)fluoranthene**	**27**	**130000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**130000**	**11000**	**C**	**Y**	**ASV**
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/kg	--	0/6	19 - 7500	N/A	4700	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/6	13 - 5300	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/6	13 - 5300	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	620 J	620 J	µg/kg	SS-147: 0-2 ft BGS (5/29/2018)	1/6	57 - 23000	620 J	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/6	25 - 9700	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/6	84 - 33000	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**160 J**	**92000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**2/6**	**21 - 200**	**92000**	**--**		**Y**	**AD**
218-01-9	**Chrysene**	**57**	**250000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**250000**	**110000**	**C**	**Y**	**ASV**
53-70-3	**Dibenz(a,h)anthracene**	**9.3**	**39000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**4/6**	**0.74 - 7**	**39000**	**110**	**C**	**Y**	**ASV**
132-64-9	**Dibenzofuran**	**72 J**	**30000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**2/6**	**15 - 140**	**30000**	**7300**	**N**	**Y**	**ASV**
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/6	35 - 14000	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/6	16 - 6200	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	25 J	25 J	µg/kg	SS-151: 0-2 ft BGS (5/16/2018)	1/6	25 - 9700	25 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/6	31 - 12000	N/A	63000	N	N	ND
206-44-0	**Fluoranthene**	**100**	**590000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**590000**	**240000**	**N**	**Y**	**ASV**
86-73-7	Fluorene	7.1 J	62000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	4/6	0.6 - 5.6	62000	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/6	2.4 - 930	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/6	13 - 5300	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/5	70 - 27000	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/6	10 - 4000	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**30**	**120000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**120000**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/6	13 - 5300	N/A	570000	C	N	ND
91-20-3	**Naphthalene**	**8**	**18000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**4/6**	**0.92 - 8.7**	**18000**	**3800**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/6	15 - 5700	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/6	12 - 4900	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/6	13 - 5300	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/6	65 - 26000	N/A	1000	C	N	ND
85-01-8	**Phenanthrene**	**48**	**480000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**480000**	**180000 (5)**	**N**	**Y**	**ASV**
108-95-2	Phenol	ND	ND	µg/kg	--	0/6	9 - 3500	N/A	1900000	N	N	ND
129-00-0	**Pyrene**	**90**	**450000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**450000**	**180000**	**N**	**Y**	**ASV**
	Metals											
7429-90-5	**Aluminum**	**3500 J**	**9800**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**9800**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.13 J	1.1 J	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	5/6	0.13	1.1 J	3.1	N	N	BSV
7440-38-2	**Arsenic**	**1.8**	**9.4**	**mg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**9.4**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	32	110	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	6/6	--	110	1500	N	N	BSV
7440-41-7	Beryllium	0.27	2.9	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	6/6	--	2.9	16	N	N	BSV
7440-43-9	Cadmium	0.18 J	0.67	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	6/6	--	0.67	7.1	N	N	BSV
7440-70-2	Calcium	37000	170000	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	6/6	--	170000	--		N	NAT
16065-83-1	Chromium III (trivalent)	7.5	280	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	6/6	--	280	12000	N	N	BSV

Table 2.3

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.66 J**	**0.85 J**	**mg/kg**	**SS-149: 0-2 ft BGS (5/29/2018)**	**2/6**	**0.26 - 1.4**	**0.85 J**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**1.2**	**7.9**	**mg/kg**	**SS-151: 0-2 ft BGS (5/16/2018)**	**6/6**	**--**	**7.9**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	11	50	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	6/6	--	50	310	N	N	BSV
57-12-5	Cyanide (total)	ND	ND	mg/kg	--	0/6	0.18 - 0.23	N/A	2.3	N	N	ND
7439-89-6	**Iron**	**10000**	**54000**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**54000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**9.1**	**1000**	**mg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**1000**	**400**	**C**	**Y**	**ASV**
7439-92-1	Lead - coarse fraction	100 J	100 J	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	1/1	--	100 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	210	210	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	1/1	--	210	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	110	110	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	1/1	--	110	400	C	N	BSV
7439-95-4	Magnesium	16000	65000	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	6/6	--	65000	--		N	NAT
7439-96-5	**Manganese**	**370 J**	**6000**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**6000**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.022 J	0.56	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	5/6	0.019	0.56	1.1	N	N	BSV
7440-02-0	Nickel	8.9	14	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	6/6	--	14	150	N	N	BSV
7440-09-7	Potassium	500	970	mg/kg	SS-149: 0-2 ft BGS (5/29/2018)	6/6	--	970	--		N	NAT
7782-49-2	Selenium	0.24 J	1.1	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	6/6	--	1.1	39	N	N	BSV
7440-22-4	Silver	0.021 J	0.35	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	6/6	--	0.35	39	N	N	BSV
7440-23-5	Sodium	78 J	460 J	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	6/6	--	460 J	--		N	NAT
7440-28-0	**Thallium**	**0.11 J**	**0.25**	**mg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**5/6**	**0.046**	**0.25**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**12**	**170**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**170**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	31	260	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	6/6	--	260	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/6	23 - 26	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/6	25 - 28	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/6	24 - 27	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/6	20 - 22	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/6	25 - 28	N/A	230	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	ND	ND	µg/kg	--	0/6	24 - 27	N/A	120	C	N	ND
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/6	23 - 26	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/6	1.5 - 32	N/A	190	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/6	1.6 - 33	N/A	2000	C	N	ND
50-29-3	4,4'-DDT	1.4 J	1.4 J	µg/kg	SS-147: 0-2 ft BGS (5/29/2018)	1/6	1.2 - 24	1.4 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/6	0.79 - 17	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/6	0.94 - 20	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/6	1.5 - 32	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/6	1.8 - 37	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/6	1.9 - 93	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/6	1.1 - 24	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/6	1.2 - 26	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/6	1.5 - 32	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/6	1.4 - 71	N/A	38000	N	N	ND

Table 2.3

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/6	2 - 41	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/6	1.5 - 72	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/6	0.92 - 19	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/6	1.8 - 39	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/6	1.3 - 27	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/6	1.6 - 34	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/6	1.5 - 31	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/6	6.8 - 140	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/6	26 - 540	N/A	490	C	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	**4.8**	**C**	**Y**	**(6)**

Notes:

(1) Minimum/maximum detected concentration.
(2) Based on data collected from sampling locations: SS-146, SS-147, SS-149, SS-150, SS-151, SS-153.
(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.
(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.4

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/14	0.18 - 26	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/13	0.21 - 22	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/14	0.31 - 21	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/14	0.26 - 29	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/14	0.43 - 33	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/13	0.19 - 24	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/13	0.54 - 44	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/14	0.28 - 21	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/13	0.18 - 17	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/14	0.23 - 28	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/14	0.25 - 28	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/13	0.23 - 35	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	23 J	23 J	µg/kg	TT-18: 5 ft BGS (10/1/2008)	1/14	0.28 - 25	23 J	2600	C	N	BSV
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	4.3 J	13 J	µg/kg	SS-150: 0-2 ft BGS (5/29/2018)	9/14	1.1 - 46	13 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/14	0.46 - 79	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/14	0.71 - 37	N/A	3300000	N	N	ND
67-64-1	Acetone	22	63	µg/kg	SS-150: 0-2 ft BGS (5/29/2018)	7/14	2.7 - 130	63	6100000	N	N	BSV
71-43-2	Benzene	0.33 J	0.33 J	µg/kg	BH157-18: 12-14 ft BGS (5/17/2018)	1/14	0.26 - 22	0.33 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/14	0.26 - 17	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/14	0.32 - 21	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/14	0.47 - 26	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/14	0.17 - 17	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/14	0.2 - 25	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/14	0.26 - 28	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/14	0.3 - 26	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/14	0.18 - 22	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/14	0.3 - 17	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.47 J	0.47 J	µg/kg	SS-153: 0-2 ft BGS (5/17/2018)	1/14	0.23 - 32	0.47 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/14	0.21 - 21	N/A	1800	C	N	ND
110-82-7	Cyclohexane	0.43 J	210 J	µg/kg	TT-18: 5 ft BGS (10/1/2008)	3/15	0.17 - 28	210 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/14	0.24 - 31	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/14	0.28 - 20	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	0.38 J	380	µg/kg	GP07-18: 12-13 ft bgs (8/1/2018)	2/14	0.22 - 4.9	380	5800	C	N	BSV
98-82-8	Isopropyl benzene	140 J	140 J	µg/kg	GP07-18: 12-13 ft bgs (8/1/2018)	1/14	0.16 - 4.9	140 J	190000	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/14	0.93 - 69	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	0.55 J	410 J	µg/kg	TT-18: 5 ft BGS (10/1/2008)	5/15	0.18 - 1.4	410 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/14	0.22 - 24	N/A	47000	C	N	ND
75-09-2	Methylene chloride	500 J	500 J	µg/kg	TT-18: 5- ft BGS (10/1/2008)	1/15	0.19 - 60	500 J	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/14	0.22 - 9.2	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/14	0.3 - 19	N/A	8100	N	N	ND
108-88-3	Toluene	0.92 J	430	µg/kg	GP07-18: 12-13 ft bgs (8/1/2018)	3/14	0.27 - 4.9	430	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/14	0.3 - 32	N/A	160000	N	N	ND

Table 2.4

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/14	0.17 - 14	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/14	0.33 - 34	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/14	0.19 - 31	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/14	0.39 - 21	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/14	0.22 - 16	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	0.68 J	2800	µg/kg	GP07-18: 12-13 ft bgs (8/1/2018)	3/14	0.32 - 1.8	2800	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/14	11 - 4400	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/14	73 - 30000	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/14	68 - 28000	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/14	47 - 19000	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/14	43 - 18000	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/13	150 - 63000	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/14	66 - 27000	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/14	60 - 25000	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/14	15 - 6200	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/14	11 - 4400	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	5.9 J	6300	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	12/14	0.53 - 0.58	6300	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/14	33 - 14000	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/14	43 - 18000	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/14	14 - 5700	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/12	31 - 13000	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/14	46 - 19000	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/14	52 - 22000	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/2	210 - 270	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/13	85 - 35000	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/14	15 - 6200	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/14	48 - 20000	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/14	32 - 13000	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/14	15 - 6200	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/14	64 - 26000	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/14	100 - 42000	N/A	--		N	ND
83-32-9	Acenaphthene	5.0 J	54000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	8/14	0.83 - 9.1	54000	360000	N	N	BSV
208-96-8	Acenaphthylene	4.9 J	1100	µg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	7/14	0.37 - 150	1100	360000 (5)	N	N	BSV
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/14	12 - 4900	N/A	780000	N	N	ND
120-12-7	Anthracene	4.8 J	120000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	13/14	0.91 - 9.1	120000	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/14	38 - 16000	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/kg	--	0/14	24 - 10000	N/A	170000	N	N	ND
56-55-3	**Benzo(a)anthracene**	**28 J**	**260000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**13/14**	**0.73 - 9.1**	**260000**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**11 J**	**270000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**13/14**	**9.1**	**270000**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**15 J**	**330000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**13/14**	**9.1**	**330000**	**1100**	**C**	**Y**	**ASV**

Table 2.4

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	24 J	120000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	13/14	0.41 - 9.1	120000	180000 (5)	N	N	BSV
207-08-9	**Benzo(k)fluoranthene**	**17 J**	**130000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**12/14**	**0.74 - 9.1**	**130000**	**11000**	**C**	**Y**	**ASV**
92-52-4	Biphenyl (1,1-Biphenyl)	260 J	260 J	µg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	1/14	18 - 7500	260 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/14	13 - 5300	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/14	13 - 5300	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	73 J	620 J	µg/kg	SS-147: 0-2 ft BGS (5/29/2018)	3/14	53 - 23000	620 J	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/14	23 - 9700	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/14	80 - 33000	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**72 J**	**92000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**4/14**	**20 - 200**	**92000**	**--**		**Y**	**AD**
218-01-9	**Chrysene**	**35 J**	**250000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**13/14**	**1.3 - 9.1**	**250000**	**110000**	**C**	**Y**	**ASV**
53-70-3	**Dibenz(a,h)anthracene**	**9.3**	**39000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**8/14**	**0.72 - 9.1**	**39000**	**110**	**C**	**Y**	**ASV**
132-64-9	**Dibenzofuran**	**72 J**	**30000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**4/14**	**14 - 140**	**30000**	**7300**	**N**	**Y**	**ASV**
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/14	33 - 14000	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/14	15 - 6200	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	25 J	25 J	µg/kg	SS-151: 0-2 ft BGS (5/16/2018)	1/14	23 - 9700	25 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/14	30 - 12000	N/A	63000	N	N	ND
206-44-0	**Fluoranthene**	**19 J**	**590000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**13/14**	**9.1**	**590000**	**240000**	**N**	**Y**	**ASV**
86-73-7	Fluorene	6.3 J	62000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	9/14	0.58 - 9.1	62000	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/14	2.2 - 930	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/14	13 - 5300	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/13	66 - 27000	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/14	9.6 - 4000	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**24 J**	**120000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**13/14**	**0.41 - 9.1**	**120000**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/14	13 - 5300	N/A	570000	C	N	ND
91-20-3	**Naphthalene**	**5.3 J**	**18000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**9/14**	**0.87 - 9.1**	**18000**	**3800**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/14	14 - 5700	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/14	12 - 4900	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/14	13 - 5300	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/14	62 - 26000	N/A	1000	C	N	ND
85-01-8	**Phenanthrene**	**7.9 J**	**480000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**13/14**	**9.1**	**480000**	**180000 (5)**	**N**	**Y**	**ASV**
108-95-2	Phenol	ND	ND	µg/kg	--	0/14	8.5 - 3500	N/A	1900000	N	N	ND
129-00-0	**Pyrene**	**17 J**	**450000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**13/14**	**9.1**	**450000**	**180000**	**N**	**Y**	**ASV**
	Metals											
7429-90-5	**Aluminum**	**1500 J**	**9800**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**14/14**	**--**	**9800**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.13 J**	**5.0 J**	**mg/kg**	**BH152-18: 9-11 ft BGS (5/29/2018)**	**11/14**	**0.12 - 6.4**	**5.0 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**1.8**	**17.7**	**mg/kg**	**TT-18: 5- ft BGS (10/1/2008)**	**14/14**	**--**	**17.7**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	17.8 J	389	mg/kg	TT-18: 5- ft BGS (10/1/2008)	14/14	--	389	1500	N	N	BSV
7440-41-7	Beryllium	0.099 J	2.9	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	14/14	--	2.9	16	N	N	BSV
7440-43-9	**Cadmium**	**0.091 J**	**15**	**mg/kg**	**BH152-18: 9-11 ft BGS (5/29/2018)**	**13/14**	**0.68**	**15**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	5650	220000	mg/kg	BH157-18: 12-14 ft BGS (5/17/2018)	14/14	--	220000	--		N	NAT
16065-83-1	Chromium III (trivalent)	3.6	280	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	14/14	--	280	12000	N	N	BSV

Table 2.4

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.31 J**	**1.7**	**mg/kg**	**TT-18: 5- ft BGS (10/1/2008)**	**6/14**	**0.25 - 1.4**	**1.7**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**1.2**	**7.9**	**mg/kg**	**SS-151: 0-2 ft BGS (5/16/2018)**	**14/14**	**--**	**7.9**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	6.7	96	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	14/14	--	96	310	N	N	BSV
57-12-5	Cyanide (total)	0.24 J	0.52 J	mg/kg	TT-18: 12- ft BGS (10/1/2008)	3/14	0.18 - 0.68	0.52 J	2.3	N	N	BSV
7439-89-6	**Iron**	**6040**	**54000**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**14/14**	**--**	**54000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**6.4 J**	**1000**	**mg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**14/14**	**--**	**1000**	**400**	**C**	**Y**	**ASV**
7439-92-1	Lead - coarse fraction	100 J	100 J	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	1/1	--	100 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	210	210	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	1/1	--	210	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	110	110	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	1/1	--	110	400	C	N	BSV
7439-95-4	Magnesium	1290	65000	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	14/14	--	65000	--		N	NAT
7439-96-5	**Manganese**	**84.9**	**6000**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**14/14**	**--**	**6000**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.022 J	0.61	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	10/14	0.018 - 0.14	0.61	1.1	N	N	BSV
7440-02-0	Nickel	7.4	28	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	14/14	--	28	150	N	N	BSV
7440-09-7	Potassium	365 J	1200	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	14/14	--	1200	--		N	NAT
7782-49-2	Selenium	0.24 J	3.7 J	mg/kg	TT-18: 5- ft BGS (10/1/2008)	13/14	26.6	3.7 J	39	N	N	BSV
7440-22-4	Silver	0.021 J	1.9	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	11/14	0.021 - 1.4	1.9	39	N	N	BSV
7440-23-5	Sodium	61 J	620	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	14/14	--	620	--		N	NAT
7440-28-0	**Thallium**	**0.083 J**	**0.54**	**mg/kg**	**TT-18: 5- ft BGS (10/1/2008)**	**12/14**	**0.046 - 0.11**	**0.54**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**5.2**	**170**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**14/14**	**--**	**170**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	10.3	1600	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	14/14	--	1600	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/14	23 - 130	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/14	25 - 140	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/14	24 - 130	N/A	170	C	N	ND
53469-21-9	**Aroclor-1242 (PCB-1242)**	**980**	**980**	**µg/kg**	**BH153-18: 13-15 ft BGS (5/29/2018)**	**1/14**	**20 - 45**	**980**	**230**	**C**	**Y**	**ASV**
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/14	25 - 140	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**70**	**1300**	**µg/kg**	**BH153-18: 13-15 ft BGS (5/29/2018)**	**2/14**	**24 - 45**	**1300**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/14	23 - 130	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	2.8 J	2.8 J	µg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	1/14	1.5 - 36	2.8 J	190	C	N	BSV
72-55-9	4,4'-DDE	2.1 J	28	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	2/14	1.6 - 36	28	2000	C	N	BSV
50-29-3	4,4'-DDT	1.4 J	1.4 J	µg/kg	SS-147: 0-2 ft BGS (5/29/2018)	1/14	1.2 - 36	1.4 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/14	0.79 - 36	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/14	0.94 - 36	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	4.0 J	36	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	2/14	1.5 - 36	36	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/14	1.8 - 37	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/14	1.8 - 100	N/A	300	C	N	ND
60-57-1	Dieldrin	2.0 NJ	2.0 NJ	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	1/14	1.1 - 36	2.0 NJ	34	C	N	BSV
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/14	1.2 - 36	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	4.3 NJ	4.3 NJ	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	1/14	1.5 - 36	4.3 NJ	47000	N	N	BSV
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/14	1.3 - 78	N/A	38000	N	N	ND

Table 2.4

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/14	2 - 41	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/14	1.4 - 79	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/14	0.92 - 36	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	3.8 J	3.8 J	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	1/14	1.8 - 39	3.8 J	570	C	N	BSV
5103-74-2	gamma-Chlordane	3.6 J	30 J	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	2/14	1.3 - 36	30 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/14	1.6 - 36	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	2.0 J	8.0 NJ	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	2/14	1.5 - 36	8.0 NJ	70	C	N	BSV
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/14	6.8 - 140	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/14	26 - 1400	N/A	490	C	N	ND
	Herbicides											
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/2	21 - 27	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/2	85 - 110	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/6	1	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH152-18, BH153-18, BH154-18, BH155-18, BH156-18, BH157-18, SS-146, SS-147, SS-149, SS-150, SS-151, SS-153, TT-18.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.5

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	1.0 J	94 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	1/6	0.41 - 50	94 J	810000	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/4	1.2 - 43	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/5	0.63 - 41	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/6	0.53 - 56	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/6	0.77 - 65	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/4	0.49 - 47	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/4	3.1 - 86	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/5	0.57 - 41	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/4	0.95 - 32	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/6	0.47 - 54	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/6	0.5 - 54	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/4	0.7 - 68	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/4	0.76 - 49	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ND	ND	µg/kg	--	0/6	2.1 - 90	N/A	2700000	N	N	ND
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/5	0.94 - 150	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/6	1.4 - 72	N/A	3300000	N	N	ND
67-64-1	Acetone	ND	ND	µg/kg	--	0/6	5 - 170	N/A	6100000	N	N	ND
71-43-2	Benzene	ND	ND	µg/kg	--	0/6	0.52 - 43	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/6	0.53 - 32	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/5	0.65 - 41	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/6	0.85 - 50	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/6	0.34 - 32	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/6	0.41 - 49	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/5	0.53 - 54	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/6	0.62 - 50	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/6	0.37 - 43	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/6	0.62 - 32	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/6	0.45 - 63	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/6	0.42 - 41	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/6	0.34 - 54	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/5	0.49 - 61	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/6	0.57 - 40	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/5	0.44 - 63	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/5	0.32 - 61	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/6	1.9 - 130	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	0.55 J	0.55 J	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	1/6	0.37 - 67	0.55 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/6	0.44 - 47	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/6	0.39 - 120	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/5	0.44 - 18	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	72 J	72 J	µg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	1/5	0.6 - 0.8	72 J	8100	N	N	BSV
108-88-3	Toluene	ND	ND	µg/kg	--	0/5	0.55 - 43	N/A	490000	N	N	ND
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/6	0.4 - 63	N/A	160000	N	N	ND

Table 2.5

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/5	0.34 - 27	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/6	0.54 - 67	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/6	0.39 - 61	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/6	0.79 - 41	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/6	0.45 - 31	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/5	0.65 - 50	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/6	11 - 46	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/6	77 - 320	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/6	71 - 290	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/6	49 - 200	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/6	44 - 180	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/6	160 - 650	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/6	69 - 280	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/6	62 - 260	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/6	16 - 64	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/6	11 - 46	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	6.4 J	240	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	5/6	2.3	240	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/6	34 - 140	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/6	44 - 180	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/6	14 - 59	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/6	32 - 130	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/6	48 - 200	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/6	55 - 220	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/0	--	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/6	89 - 370	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/6	16 - 64	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/6	50 - 210	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/6	33 - 140	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/6	16 - 64	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/6	67 - 270	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/6	100 - 430	N/A	--		N	ND
83-32-9	Acenaphthene	190	190	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	1/6	0.85 - 3.5	190	360000	N	N	BSV
208-96-8	Acenaphthylene	8.8	45	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	3/6	0.4 - 0.58	45	360000 (5)	N	N	BSV
98-86-2	Acetophenone	25 J	25 J	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	1/6	13 - 50	25 J	780000	N	N	BSV
120-12-7	Anthracene	7.3 J	480	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	4/6	0.9 - 1.3	480	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/6	40 - 160	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	39 J	120 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	2/6	26 - 110	120 J	170000	N	N	BSV
56-55-3	Benzo(a)anthracene	11	1100	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	6/6	--	1100	1100	C	N	BSV
50-32-8	**Benzo(a)pyrene**	**8.7 J**	**1100**	**µg/kg**	**SS-145: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**1100**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**14**	**1300**	**µg/kg**	**SS-145: 0-2 ft BGS (5/29/2018)**	**6/6**	**--**	**1300**	**1100**	**C**	**Y**	**ASV**

Table 2.5

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	7.9 J	790	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	5/6	0.4	790	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	7.1 J	480	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	5/6	0.78 - 1.1	480	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	25 J	25 J	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	1/6	20 - 78	25 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/6	13 - 55	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/6	13 - 55	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	110 J	4700	µg/kg	SS-142: 0-2 ft BGS (5/29/2018)	2/6	57 - 140	4700	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/6	24 - 100	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/6	83 - 340	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**130 J**	**130 J**	**µg/kg**	**SS-145: 0-2 ft BGS (5/29/2018)**	**1/6**	**21 - 87**	**130 J**	**--**		**Y**	**AD**
218-01-9	Chrysene	12	1100	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	6/6	--	1100	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**12**	**180**	**µg/kg**	**SS-145: 0-2 ft BGS (5/29/2018)**	**3/6**	**0.76 - 1.1**	**180**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	16 J	100 J	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	3/6	18 - 59	100 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/6	34 - 140	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/6	16 - 64	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	26 J	250	µg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	2/6	25 - 100	250	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/6	31 - 130	N/A	63000	N	N	ND
206-44-0	Fluoranthene	19	2900	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	6/6	--	2900	240000	N	N	BSV
86-73-7	Fluorene	8.5	150	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	3/6	0.61 - 0.87	150	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/6	2.3 - 9.6	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/6	13 - 55	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/6	69 - 280	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/6	10 - 41	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	5.5 J	610	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	5/6	0.4	610	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/6	13 - 55	N/A	570000	C	N	ND
91-20-3	Naphthalene	10	150	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	6/6	--	150	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/6	14 - 59	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/6	12 - 50	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/6	13 - 55	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/6	65 - 260	N/A	1000	C	N	ND
85-01-8	Phenanthrene	15	1900	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	6/6	--	1900	180000 (5)	N	N	BSV
108-95-2	Phenol	13 J	27 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	1/6	8.9 - 37	27 J	1900000	N	N	BSV
129-00-0	Pyrene	20	2400	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	6/6	--	2400	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**4800 J**	**15000 J**	**mg/kg**	**SS-138: 0-2 ft BGS (5/17/2018)**	**6/6**	**--**	**15000 J**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.16 J**	**12 J**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**6/6**	**--**	**12 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**7.3**	**50**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**6/6**	**--**	**50**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	50	420	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	6/6	--	420	1500	N	N	BSV
7440-41-7	Beryllium	0.51	5.2	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	6/6	--	5.2	16	N	N	BSV
7440-43-9	Cadmium	0.16 J	0.92	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	6/6	--	0.92	7.1	N	N	BSV
7440-70-2	Calcium	47000	100000	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	6/6	--	100000	--		N	NAT
16065-83-1	Chromium III (trivalent)	9.9	21	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	6/6	--	21	12000	N	N	BSV

Table 2.5

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.51 J**	**1.3**	**mg/kg**	**SS-138: 0-2 ft BGS (5/17/2018)**	**4/6**	**0.28**	**1.3**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**5.2**	**27**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**6/6**	**--**	**27**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	16	92	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	6/6	--	92	310	N	N	BSV
57-12-5	Cyanide (total)	0.51 J	0.79 J	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	2/6	0.21 - 0.26	0.79 J	2.3	N	N	BSV
7439-89-6	**Iron**	**11000**	**18000**	**mg/kg**	**SS-144: 0.17-2.17 ft BGS (5/29/2018)**	**6/6**	**--**	**18000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	13	130	mg/kg	SS-145: 0-2 ft BGS (5/29/2018)	6/6	--	130	400	C	N	BSV
7439-92-1	Lead - coarse fraction	33 J	33 J	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	1/1	--	33 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	50	50	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	1/1	--	50	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	36	36	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	1/1	--	36	400	C	N	BSV
7439-95-4	Magnesium	3700	26000	mg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	6/6	--	26000	--		N	NAT
7439-96-5	**Manganese**	**130 J**	**410**	**mg/kg**	**SS-144: 0.17-2.17 ft BGS (5/29/2018)**	**6/6**	**--**	**410**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.026 J	0.45	mg/kg	SS-145: 0-2 ft BGS (5/29/2018)	6/6	--	0.45	1.1	N	N	BSV
7440-02-0	Nickel	12	51	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	6/6	--	51	150	N	N	BSV
7440-09-7	Potassium	590	2200	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	6/6	--	2200	--		N	NAT
7782-49-2	Selenium	0.43 J	5.3	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	6/6	--	5.3	39	N	N	BSV
7440-22-4	Silver	0.032 J	1.9	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	6/6	--	1.9	39	N	N	BSV
7440-23-5	Sodium	71 J	400	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	6/6	--	400	--		N	NAT
7440-28-0	**Thallium**	**0.13 J**	**1.3**	**mg/kg**	**SS-138: 0-2 ft BGS (5/17/2018)**	**6/6**	**--**	**1.3**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**15**	**61**	**mg/kg**	**SS-138: 0-2 ft BGS (5/17/2018)**	**6/6**	**--**	**61**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	32	280	mg/kg	SS-145: 0-2 ft BGS (5/29/2018)	6/6	--	280	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/6	24 - 36	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/6	27 - 39	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/6	25 - 38	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/6	21 - 31	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/6	27 - 39	N/A	230	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	27 J	110	µg/kg	SS-142: 0-2 ft BGS (5/29/2018)	2/6	25 - 38	110	120	C	N	BSV
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/6	24 - 36	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	1.8 J	2.8 NJ	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	3/6	1.7 - 17	2.8 NJ	190	C	N	BSV
72-55-9	4,4'-DDE	8.3	8.3	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	1/6	1.6 - 17	8.3	2000	C	N	BSV
50-29-3	4,4'-DDT	2.3 NJ	4.6 J	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	3/6	1.6 - 13	4.6 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/6	0.83 - 8.9	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/6	0.98 - 10	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	2.5 J	2.5 J	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	1/6	1.6 - 17	2.5 J	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/6	1.9 - 20	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/6	1.8 - 19	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/6	1.2 - 13	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/6	1.3 - 14	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/6	1.6 - 17	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/6	1.4 - 15	N/A	38000	N	N	ND

Table 2.5

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/6	2 - 22	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/6	1.4 - 15	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	1.4 NJ	21 J	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	2/6	0.96 - 1.5	21 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/6	1.9 - 21	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	2.7 J	2.8 J	µg/kg	SS-142: 0-2 ft BGS (5/29/2018)	2/6	1.3 - 14	2.8 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/6	1.7 - 18	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/6	1.6 - 17	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/6	7.1 - 75	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/6	27 - 290	N/A	490	C	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**

Notes:

(1) Minimum/maximum detected concentration.
(2) Based on data collected from sampling locations: SS-138, SS-139, SS-140, SS-142, SS-144, SS-145.
(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.
(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.6

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	1.0 J	94 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	1/14	0.21 - 50	94 J	810000	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/11	0.23 - 43	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/12	0.35 - 41	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/14	0.3 - 56	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/14	0.48 - 65	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/11	0.22 - 47	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/11	0.61 - 86	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/12	0.31 - 41	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/11	0.2 - 32	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/14	0.26 - 54	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/14	0.28 - 54	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/11	0.26 - 68	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/11	0.31 - 49	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	5.8 J	9.9 J	µg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	3/14	1.1 - 90	9.9 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/12	0.52 - 150	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/14	0.8 - 72	N/A	3300000	N	N	ND
67-64-1	Acetone	81 J	81 J	µg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	1/14	5 - 170	81 J	6100000	N	N	BSV
71-43-2	Benzene	0.46 J	0.90 J	µg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	2/14	0.52 - 43	0.90 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/14	0.3 - 32	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/12	0.36 - 41	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/14	0.53 - 50	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/14	0.19 - 32	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/14	0.22 - 49	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/12	0.3 - 54	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/14	0.34 - 50	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/14	0.21 - 43	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/14	0.34 - 32	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/14	0.25 - 63	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/14	0.23 - 41	N/A	1800	C	N	ND
110-82-7	Cyclohexane	0.43 J	1.2 J	µg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	2/14	0.34 - 54	1.2 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/12	0.27 - 61	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/14	0.31 - 40	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	0.78 J	0.78 J	µg/kg	BH147-18: 12-14 ft BGS (5/17/2018)	1/12	0.44 - 63	0.78 J	5800	C	N	BSV
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/12	0.18 - 61	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/14	1 - 130	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	0.55 J	2.0 J	µg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	3/14	0.37 - 67	2.0 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/14	0.24 - 47	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/14	0.22 - 120	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/12	0.24 - 18	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	0.34 J	72 J	µg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	2/12	0.6 - 6.1	72 J	8100	N	N	BSV
108-88-3	Toluene	1.0 J	1.8 J	µg/kg	BH147-18: 12-14 ft BGS (5/17/2018)	3/12	0.55 - 43	1.8 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/14	0.34 - 63	N/A	160000	N	N	ND

Table 2.6

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/12	0.19 - 27	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/14	0.37 - 67	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/14	0.22 - 61	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/14	0.44 - 41	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/14	0.25 - 31	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	1.4 J	1.4 J	µg/kg	BH147-18: 12-14 ft BGS (5/17/2018)	1/12	0.65 - 50	1.4 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/14	11 - 500	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/14	75 - 750	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/14	69 - 750	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/14	48 - 750	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/14	43 - 750	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/14	150 - 1600	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/14	67 - 1000	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/14	61 - 1000	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/14	15 - 250	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/14	11 - 250	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	6.4 J	240	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	11/14	0.94 - 7.3	240	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/14	34 - 1000	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/14	43 - 1000	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/14	14 - 250	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/12	31 - 130	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/14	47 - 500	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/14	53 - 1000	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/2	220 - 1000	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/14	87 - 750	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/14	15 - 250	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/14	49 - 750	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/14	32 - 750	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/14	15 - 250	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/14	65 - 1000	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/14	100 - 1600	N/A	--		N	ND
83-32-9	Acenaphthene	4.4 J	250	µg/kg	TT-17: 14- ft BGS (9/30/2008)	5/14	0.85 - 3.5	250	360000	N	N	BSV
208-96-8	Acenaphthylene	8.8	45	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	5/14	0.38 - 33	45	360000 (5)	N	N	BSV
98-86-2	Acetophenone	25 J	25 J	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	1/14	12 - 500	25 J	780000	N	N	BSV
120-12-7	Anthracene	7.3 J	480	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	10/14	0.9 - 1.5	480	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/14	39 - 1000	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	39 J	120 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	2/14	25 - 500	120 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**11**	**1200**	**µg/kg**	**TT-17: 14- ft BGS (9/30/2008)**	**13/14**	**0.97**	**1200**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**8.7 J**	**1100**	**µg/kg**	**SS-145: 0-2 ft BGS (5/29/2018)**	**13/14**	**0.99**	**1100**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**12 J**	**1300**	**µg/kg**	**SS-145: 0-2 ft BGS (5/29/2018)**	**13/14**	**0.91**	**1300**	**1100**	**C**	**Y**	**ASV**

Table 2.6

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	7.9 J	790	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	12/14	0.4 - 0.54	790	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	7.1 J	600	µg/kg	TT-17: 14- ft BGS (9/30/2008)	10/14	0.78 - 1.3	600	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	25 J	25 J	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	1/14	18 - 250	25 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/14	13 - 500	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/14	13 - 500	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	78 J	4700	µg/kg	SS-142: 0-2 ft BGS (5/29/2018)	5/14	55 - 250	4700	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/14	24 - 250	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/14	81 - 1600	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**22 J**	**400**	**µg/kg**	**TT-17: 14- ft BGS (9/30/2008)**	**4/14**	**21 - 87**	**400**	**--**		**Y**	**AD**
218-01-9	Chrysene	12	1400	µg/kg	TT-17: 14- ft BGS (9/30/2008)	13/14	1.7	1400	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**6.2 J**	**180**	**µg/kg**	**SS-145: 0-2 ft BGS (5/29/2018)**	**8/14**	**0.76 - 1.2**	**180**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	16 J	180 J	µg/kg	TT-17: 14 ft BGS (9/30/2008)	4/14	14 - 59	180 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/14	34 - 250	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/14	15 - 250	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	26 J	250	µg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	3/14	25 - 250	250	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/14	30 - 250	N/A	63000	N	N	ND
206-44-0	Fluoranthene	19	3700	µg/kg	TT-17: 14- ft BGS (9/30/2008)	13/14	0.85	3700	240000	N	N	BSV
86-73-7	Fluorene	3.8 J	250	µg/kg	TT-17: 14- ft BGS (9/30/2008)	7/14	0.61 - 1	250	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/14	2.3 - 33	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/14	13 - 250	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/14	67 - 1600	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/14	9.7 - 250	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	5.5 J	610	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	10/14	0.4 - 0.66	610	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/14	13 - 250	N/A	570000	C	N	ND
91-20-3	Naphthalene	10	150	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	11/14	1 - 7.3	150	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/14	14 - 500	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/14	12 - 250	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/14	13 - 250	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/14	63 - 750	N/A	1000	C	N	ND
85-01-8	Phenanthrene	5.8 J	3400	µg/kg	TT-17: 14- ft BGS (9/30/2008)	14/14	--	3400	180000 (5)	N	N	BSV
108-95-2	Phenol	13 J	27 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	1/14	8.7 - 250	27 J	1900000	N	N	BSV
129-00-0	Pyrene	20	2900	µg/kg	TT-17: 14- ft BGS (9/30/2008)	13/14	0.68	2900	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**2400 J**	**15000 J**	**mg/kg**	**SS-138: 0-2 ft BGS (5/17/2018)**	**14/14**	**--**	**15000 J**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.16 J**	**12 J**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**11/14**	**0.12 - 6.6**	**12 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**0.74 J**	**56**	**mg/kg**	**BH148-18: 6-8 ft BGS (5/17/2018)**	**14/14**	**--**	**56**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	9.6	420	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	14/14	--	420	1500	N	N	BSV
7440-41-7	Beryllium	0.19 J	5.2	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	14/14	--	5.2	16	N	N	BSV
7440-43-9	Cadmium	0.11 J	0.92	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	13/14	0.07	0.92	7.1	N	N	BSV
7440-70-2	Calcium	5400	410000	mg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	14/14	--	410000	--		N	NAT
16065-83-1	Chromium III (trivalent)	2.1	21	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	14/14	--	21	12000	N	N	BSV

Table 2.6

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.51 J**	**1.5**	**mg/kg**	**TT-17: 5- ft BGS (9/30/2008)**	**10/14**	**0.28 - 1.5**	**1.5**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**0.77**	**27**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**14/14**	**--**	**27**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	3.5	92	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	14/14	--	92	310	N	N	BSV
57-12-5	Cyanide (total)	0.22 J	1.3	mg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	5/14	0.2 - 0.55	1.3	2.3	N	N	BSV
7439-89-6	**Iron**	**1200**	**19000**	**mg/kg**	**BH150-18: 13-15 ft BGS (5/29/2018)**	**14/14**	**--**	**19000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	2.1	130	mg/kg	SS-145: 0-2 ft BGS (5/29/2018)	14/14	--	130	400	C	N	BSV
7439-92-1	Lead - coarse fraction	33 J	33 J	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	1/1	--	33 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	50	50	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	1/1	--	50	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	36	36	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	1/1	--	36	400	C	N	BSV
7439-95-4	Magnesium	1100	51000	mg/kg	BH147-18: 12-14 ft BGS (5/17/2018)	14/14	--	51000	--		N	NAT
7439-96-5	**Manganese**	**37 J**	**620**	**mg/kg**	**BH151-18: 10-12 ft BGS (5/29/2018)**	**14/14**	**--**	**620**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.026 J	0.45	mg/kg	SS-145: 0-2 ft BGS (5/29/2018)	12/14	0.019 - 0.034	0.45	1.1	N	N	BSV
7440-02-0	Nickel	7.5	51	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	14/14	--	51	150	N	N	BSV
7440-09-7	Potassium	180 J	2200	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	14/14	--	2200	--		N	NAT
7782-49-2	Selenium	0.15 J	10	mg/kg	BH148-18: 6-8 ft BGS (5/17/2018)	13/14	27.5	10	39	N	N	BSV
7440-22-4	Silver	0.032 J	1.9	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	10/14	0.022 - 1.2	1.9	39	N	N	BSV
7440-23-5	Sodium	59 J	400	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	11/14	83 - 625	400	--		N	NAT
7440-28-0	**Thallium**	**0.083 J**	**1.5**	**mg/kg**	**BH148-18: 6-8 ft BGS (5/17/2018)**	**12/14**	**0.078 - 0.15**	**1.5**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**9**	**70**	**mg/kg**	**BH148-18: 6-8 ft BGS (5/17/2018)**	**14/14**	**--**	**70**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	6.5	280	mg/kg	SS-145: 0-2 ft BGS (5/29/2018)	14/14	--	280	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/14	24 - 42	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/14	27 - 46	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/14	25 - 44	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/14	21 - 41	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	59	59	µg/kg	TT-17: 14- ft BGS (9/30/2008)	1/14	27 - 46	59	230	C	N	BSV
11097-69-1	**Aroclor-1254 (PCB-1254)**	**27 J**	**210**	**µg/kg**	**BH150-18: 13-15 ft BGS (5/29/2018)**	**5/14**	**25 - 44**	**210**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/14	24 - 42	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	1.8 J	2.8 NJ	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	3/14	1.7 - 190	2.8 NJ	190	C	N	BSV
72-55-9	4,4'-DDE	8.3	8.3	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	1/14	1.6 - 190	8.3	2000	C	N	BSV
50-29-3	4,4'-DDT	2.3 NJ	4.6 J	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	4/14	1.3 - 190	4.6 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/14	0.83 - 190	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/14	0.98 - 190	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	2.5 J	2.5 J	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	1/14	1.6 - 190	2.5 J	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/14	1.9 - 190	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/14	1.8 - 190	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/14	1.2 - 190	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/14	1.3 - 190	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/14	1.6 - 190	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/14	1.4 - 190	N/A	38000	N	N	ND

Table 2.6

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU04 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/14	2 - 190	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	1.9 J	1.9 J	µg/kg	BH150-18: 13-15 ft BGS (5/29/2018)	1/14	1.4 - 190	1.9 J	1900	N	N	BSV
53494-70-5	Endrin ketone	1.4 NJ	21 J	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	2/14	0.96 - 190	21 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/14	1.9 - 190	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	2.7 J	2.8 J	µg/kg	SS-142: 0-2 ft BGS (5/29/2018)	2/14	1.3 - 190	2.8 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/14	1.7 - 190	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/14	1.6 - 190	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/14	7.1 - 360	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/14	27 - 7400	N/A	490	C	N	ND
	Herbicides											
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/2	22 - 25	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/2	88 - 100	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/6	1	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH146-18, BH147-18, BH148-18, BH149-18, BH150-18, BH151-18,GP08-19, SS-138, SS-139, SS-140, SS-142, SS-144, SS-145, TT-17.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.7

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 and EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	1.0 J	94 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	1/12	0.18 - 50	94 J	810000	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/10	0.21 - 43	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/11	0.31 - 41	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/12	0.26 - 56	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/12	0.43 - 65	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/10	0.19 - 47	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/10	0.54 - 86	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/11	0.28 - 41	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/10	0.18 - 32	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/12	0.23 - 54	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/12	0.25 - 54	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/10	0.23 - 68	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/10	0.28 - 49	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	5.4 J	13 J	µg/kg	SS-150: 0-2 ft BGS (5/29/2018)	6/12	2.1 - 90	13 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/11	0.46 - 150	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/12	0.71 - 72	N/A	3300000	N	N	ND
67-64-1	Acetone	22	63	µg/kg	SS-150: 0-2 ft BGS (5/29/2018)	6/12	5 - 170	63	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/12	0.26 - 43	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/12	0.26 - 32	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/11	0.32 - 41	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/12	0.47 - 50	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/12	0.17 - 32	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/12	0.2 - 49	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/11	0.26 - 54	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/12	0.3 - 50	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/12	0.18 - 43	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/12	0.3 - 32	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.47 J	0.47 J	µg/kg	SS-153: 0-2 ft BGS (5/17/2018)	1/12	0.23 - 63	0.47 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/12	0.21 - 41	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/12	0.17 - 54	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/11	0.24 - 61	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/12	0.28 - 40	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/11	0.22 - 63	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/11	0.16 - 61	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/12	0.93 - 130	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	0.55 J	0.55 J	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	1/12	0.18 - 67	0.55 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/12	0.22 - 47	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/12	0.19 - 120	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/11	0.22 - 18	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	72 J	72 J	µg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	1/11	0.3 - 0.8	72 J	8100	N	N	BSV
108-88-3	Toluene	ND	ND	µg/kg	--	0/11	0.27 - 43	N/A	490000	N	N	ND
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/12	0.3 - 63	N/A	160000	N	N	ND

Table 2.7

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 and EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/11	0.17 - 27	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/12	0.33 - 67	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/12	0.19 - 61	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/12	0.39 - 41	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/12	0.22 - 31	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/11	0.32 - 50	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/12	11 - 4400	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/12	77 - 30000	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/12	71 - 28000	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/12	49 - 19000	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/12	44 - 18000	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/11	160 - 63000	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/12	69 - 27000	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/12	62 - 25000	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/12	16 - 6200	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/12	11 - 4400	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	6.4 J	6300	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	10/12	0.56 - 2.3	6300	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/12	34 - 14000	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/12	44 - 18000	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/12	14 - 5700	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/12	32 - 13000	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/12	48 - 19000	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/12	55 - 22000	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/0	--	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/11	89 - 35000	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/12	16 - 6200	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/12	50 - 20000	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/12	33 - 13000	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/12	16 - 6200	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/12	67 - 26000	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/12	100 - 42000	N/A	--		N	ND
83-32-9	Acenaphthene	5.0 J	54000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	5/12	0.85 - 8	54000	360000	N	N	BSV
208-96-8	Acenaphthylene	6.1 J	79	µg/kg	SS-149: 0-2 ft BGS (5/29/2018)	6/12	0.39 - 150	79	360000 (5)	N	N	BSV
98-86-2	Acetophenone	25 J	25 J	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	1/12	12 - 4900	25 J	780000	N	N	BSV
120-12-7	Anthracene	7.3 J	120000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	10/12	0.9 - 1.3	120000	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/12	40 - 16000	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	39 J	120 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	2/12	26 - 10000	120 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**11**	**260000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**260000**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**8.7 J**	**270000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**270000**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**14**	**330000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**330000**	**1100**	**C**	**Y**	**ASV**

Table 2.7

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 and EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	7.9 J	120000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	11/12	0.4	120000	180000 (5)	N	N	BSV
207-08-9	**Benzo(k)fluoranthene**	**7.1 J**	**130000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**11/12**	**0.78 - 1.1**	**130000**	**11000**	**C**	**Y**	**ASV**
92-52-4	Biphenyl (1,1-Biphenyl)	25 J	25 J	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	1/12	19 - 7500	25 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/12	13 - 5300	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/12	13 - 5300	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	110 J	4700	µg/kg	SS-142: 0-2 ft BGS (5/29/2018)	3/12	57 - 23000	4700	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/12	24 - 9700	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/12	83 - 33000	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**130 J**	**92000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**3/12**	**21 - 200**	**92000**	**--**		**Y**	**AD**
218-01-9	**Chrysene**	**12**	**250000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**250000**	**110000**	**C**	**Y**	**ASV**
53-70-3	**Dibenz(a,h)anthracene**	**9.3**	**39000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**7/12**	**0.74 - 7**	**39000**	**110**	**C**	**Y**	**ASV**
132-64-9	**Dibenzofuran**	**16 J**	**30000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**5/12**	**15 - 140**	**30000**	**7300**	**N**	**Y**	**ASV**
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/12	34 - 14000	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/12	16 - 6200	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	25 J	250	µg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	3/12	25 - 9700	250	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/12	31 - 12000	N/A	63000	N	N	ND
206-44-0	**Fluoranthene**	**19**	**590000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**590000**	**240000**	**N**	**Y**	**ASV**
86-73-7	Fluorene	7.1 J	62000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	7/12	0.6 - 5.6	62000	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/12	2.3 - 930	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/12	13 - 5300	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/11	69 - 27000	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/12	10 - 4000	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**5.5 J**	**120000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**11/12**	**0.4**	**120000**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/12	13 - 5300	N/A	570000	C	N	ND
91-20-3	**Naphthalene**	**8**	**18000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**10/12**	**0.92 - 8.7**	**18000**	**3800**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/12	14 - 5700	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/12	12 - 4900	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/12	13 - 5300	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/12	65 - 26000	N/A	1000	C	N	ND
85-01-8	**Phenanthrene**	**15**	**480000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**480000**	**180000 (5)**	**N**	**Y**	**ASV**
108-95-2	Phenol	13 J	27 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	1/12	8.9 - 3500	27 J	1900000	N	N	BSV
129-00-0	**Pyrene**	**20**	**450000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**450000**	**180000**	**N**	**Y**	**ASV**
	Metals											
7429-90-5	**Aluminum**	**3500 J**	**15000 J**	**mg/kg**	**SS-138: 0-2 ft BGS (5/17/2018)**	**12/12**	**--**	**15000 J**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.13 J**	**12 J**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**11/12**	**0.13**	**12 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**1.8**	**50**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**12/12**	**--**	**50**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	32	420	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	12/12	--	420	1500	N	N	BSV
7440-41-7	Beryllium	0.27	5.2	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	12/12	--	5.2	16	N	N	BSV
7440-43-9	Cadmium	0.16 J	0.92	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	12/12	--	0.92	7.1	N	N	BSV
7440-70-2	Calcium	37000	170000	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	12/12	--	170000	--		N	NAT
16065-83-1	Chromium III (trivalent)	7.5	280	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	12/12	--	280	12000	N	N	BSV

Table 2.7

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 and EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.51 J**	**1.3**	**mg/kg**	**SS-138: 0-2 ft BGS (5/17/2018)**	**6/12**	**0.26 - 1.4**	**1.3**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**1.2**	**27**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**12/12**	**--**	**27**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	11	92	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	12/12	--	92	310	N	N	BSV
57-12-5	Cyanide (total)	0.51 J	0.79 J	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	2/12	0.18 - 0.26	0.79 J	2.3	N	N	BSV
7439-89-6	**Iron**	**10000**	**54000**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**54000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**9.1**	**1000**	**mg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**1000**	**400**	**C**	**Y**	**ASV**
7439-92-1	Lead - coarse fraction	33 J	100 J	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	2/2	--	100 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	50	210	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	2/2	--	210	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	36	110	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	2/2	--	110	400	C	N	BSV
7439-95-4	Magnesium	3700	65000	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	12/12	--	65000	--		N	NAT
7439-96-5	**Manganese**	**130 J**	**6000**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**6000**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.022 J	0.56	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	11/12	0.019	0.56	1.1	N	N	BSV
7440-02-0	Nickel	8.9	51	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	12/12	--	51	150	N	N	BSV
7440-09-7	Potassium	500	2200	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	12/12	--	2200	--		N	NAT
7782-49-2	Selenium	0.24 J	5.3	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	12/12	--	5.3	39	N	N	BSV
7440-22-4	Silver	0.021 J	1.9	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	12/12	--	1.9	39	N	N	BSV
7440-23-5	Sodium	71 J	460 J	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	12/12	--	460 J	--		N	NAT
7440-28-0	**Thallium**	**0.11 J**	**1.3**	**mg/kg**	**SS-138: 0-2 ft BGS (5/17/2018)**	**11/12**	**0.046**	**1.3**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**12**	**170**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**12/12**	**--**	**170**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	31	280	mg/kg	SS-145: 0-2 ft BGS (5/29/2018)	12/12	--	280	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/12	23 - 36	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/12	25 - 39	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/12	24 - 38	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/12	20 - 31	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/12	25 - 39	N/A	230	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	27 J	110	µg/kg	SS-142: 0-2 ft BGS (5/29/2018)	2/12	24 - 38	110	120	C	N	BSV
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/12	23 - 36	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	1.8 J	2.8 NJ	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	3/12	1.5 - 32	2.8 NJ	190	C	N	BSV
72-55-9	4,4'-DDE	8.3	8.3	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	1/12	1.6 - 33	8.3	2000	C	N	BSV
50-29-3	4,4'-DDT	1.4 J	4.6 J	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	4/12	1.2 - 24	4.6 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/12	0.79 - 17	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/12	0.94 - 20	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	2.5 J	2.5 J	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	1/12	1.5 - 32	2.5 J	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/12	1.8 - 37	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/12	1.8 - 93	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/12	1.1 - 24	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/12	1.2 - 26	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/12	1.5 - 32	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/12	1.4 - 71	N/A	38000	N	N	ND

Table 2.7

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 and EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/12	2 - 41	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/12	1.4 - 72	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	1.4 NJ	21 J	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	2/12	0.92 - 19	21 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/12	1.8 - 39	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	2.7 J	2.8 J	µg/kg	SS-142: 0-2 ft BGS (5/29/2018)	2/12	1.3 - 27	2.8 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/12	1.6 - 34	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/12	1.5 - 31	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/12	6.8 - 140	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/12	26 - 540	N/A	490	C	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-138, SS-139, SS-140, SS-142, SS-144, SS-145, SS-146, SS-147, SS-149, SS-150, SS-151, SS-153.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no MOE Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.8

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface and Subsurface soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03-EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	1.0 J	94 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	1/28	0.18 - 50	94 J	810000	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/24	0.21 - 43	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/26	0.31 - 41	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/28	0.26 - 56	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/28	0.43 - 65	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/24	0.19 - 47	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/24	0.54 - 86	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/26	0.28 - 41	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/24	0.18 - 32	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/28	0.23 - 54	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/28	0.25 - 54	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/24	0.23 - 68	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	23 J	23 J	µg/kg	TT-18: 5 ft BGS (10/1/2008)	1/25	0.28 - 49	23 J	2600	C	N	BSV
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	4.3 J	13 J	µg/kg	SS-150: 0-2 ft BGS (5/29/2018)	12/28	1.1 - 90	13 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/26	0.46 - 150	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/28	0.71 - 72	N/A	3300000	N	N	ND
67-64-1	Acetone	22	81 J	µg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	8/28	2.7 - 170	81 J	6100000	N	N	BSV
71-43-2	Benzene	0.33 J	0.90 J	µg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	3/28	0.26 - 43	0.90 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/28	0.26 - 32	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/26	0.32 - 41	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/28	0.47 - 50	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/28	0.17 - 32	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/28	0.2 - 49	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/26	0.26 - 54	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/28	0.3 - 50	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/28	0.18 - 43	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/28	0.3 - 32	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.47 J	0.47 J	µg/kg	SS-153: 0-2 ft BGS (5/17/2018)	1/28	0.23 - 63	0.47 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/28	0.21 - 41	N/A	1800	C	N	ND
110-82-7	Cyclohexane	0.43 J	210 J	µg/kg	TT-18: 5 ft BGS (10/1/2008)	5/29	0.17 - 54	210 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/26	0.24 - 61	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/28	0.28 - 40	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	0.38 J	380	µg/kg	GP07-18: 12-13 ft bgs (8/1/2018)	3/26	0.22 - 63	380	5800	C	N	BSV
98-82-8	Isopropyl benzene	140 J	140 J	µg/kg	GP07-18: 12-13 ft bgs (8/1/2018)	1/26	0.16 - 61	140 J	190000	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/28	0.93 - 130	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	0.55 J	410 J	µg/kg	TT-18: 5 ft BGS (10/1/2008)	8/29	0.18 - 67	410 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/28	0.22 - 47	N/A	47000	C	N	ND
75-09-2	Methylene chloride	500 J	500 J	µg/kg	TT-18: 5- ft BGS (10/1/2008)	1/29	0.19 - 120	500 J	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/26	0.22 - 18	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	0.34 J	72 J	µg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	2/26	0.3 - 19	72 J	8100	N	N	BSV
108-88-3	Toluene	0.92 J	430	µg/kg	GP07-18: 12-13 ft bgs (8/1/2018)	6/26	0.27 - 43	430	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/28	0.3 - 63	N/A	160000	N	N	ND

Table 2.8

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface and Subsurface soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03-EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/26	0.17 - 27	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/28	0.33 - 67	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/28	0.19 - 61	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/28	0.39 - 41	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/28	0.22 - 31	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	0.68 J	2800	µg/kg	GP07-18: 12-13 ft bgs (8/1/2018)	4/26	0.32 - 50	2800	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/28	11 - 4400	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/28	73 - 30000	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/28	68 - 28000	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/28	47 - 19000	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/28	43 - 18000	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/27	150 - 63000	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/28	66 - 27000	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/28	60 - 25000	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/28	15 - 6200	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/28	11 - 4400	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	5.9 J	6300	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	23/28	0.53 - 7.3	6300	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/28	33 - 14000	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/28	43 - 18000	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/28	14 - 5700	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/24	31 - 13000	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/28	46 - 19000	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/28	52 - 22000	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/4	210 - 1000	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/27	85 - 35000	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/28	15 - 6200	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/28	48 - 20000	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/28	32 - 13000	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/28	15 - 6200	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/28	64 - 26000	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/28	100 - 42000	N/A	--		N	ND
83-32-9	Acenaphthene	4.4 J	54000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	13/28	0.83 - 9.1	54000	360000	N	N	BSV
208-96-8	Acenaphthylene	4.9 J	1100	µg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	12/28	0.37 - 150	1100	360000 (5)	N	N	BSV
98-86-2	Acetophenone	25 J	25 J	µg/kg	SS-139: 0-2 ft BGS (5/17/2018)	1/28	12 - 4900	25 J	780000	N	N	BSV
120-12-7	Anthracene	4.8 J	120000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	23/28	0.9 - 9.1	120000	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/28	38 - 16000	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	39 J	120 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	2/28	24 - 10000	120 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**11**	**260000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**26/28**	**0.73 - 9.1**	**260000**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**8.7 J**	**270000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**26/28**	**0.99 - 9.1**	**270000**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**12 J**	**330000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**26/28**	**0.91 - 9.1**	**330000**	**1100**	**C**	**Y**	**ASV**

Table 2.8

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface and Subsurface soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03-EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	7.9 J	120000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	25/28	0.4 - 9.1	120000	180000 (5)	N	N	BSV
207-08-9	**Benzo(k)fluoranthene**	**7.1 J**	**130000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**22/28**	**0.74 - 9.1**	**130000**	**11000**	**C**	**Y**	**ASV**
92-52-4	Biphenyl (1,1-Biphenyl)	25 J	260 J	µg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	2/28	18 - 7500	260 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/28	13 - 5300	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/28	13 - 5300	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	73 J	4700	µg/kg	SS-142: 0-2 ft BGS (5/29/2018)	8/28	53 - 23000	4700	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/28	23 - 9700	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/28	80 - 33000	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**22 J**	**92000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**8/28**	**20 - 200**	**92000**	**--**		**Y**	**AD**
218-01-9	**Chrysene**	**12**	**250000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**26/28**	**1.3 - 9.1**	**250000**	**110000**	**C**	**Y**	**ASV**
53-70-3	**Dibenz(a,h)anthracene**	**6.2 J**	**39000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**16/28**	**0.72 - 9.1**	**39000**	**110**	**C**	**Y**	**ASV**
132-64-9	**Dibenzofuran**	**16 J**	**30000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**8/28**	**14 - 140**	**30000**	**7300**	**N**	**Y**	**ASV**
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/28	33 - 14000	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/28	15 - 6200	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	25 J	250	µg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	4/28	23 - 9700	250	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/28	30 - 12000	N/A	63000	N	N	ND
206-44-0	**Fluoranthene**	**19**	**590000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**26/28**	**0.85 - 9.1**	**590000**	**240000**	**N**	**Y**	**ASV**
86-73-7	Fluorene	3.8 J	62000	µg/kg	SS-146: 0-2 ft BGS (5/29/2018)	16/28	0.58 - 9.1	62000	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/28	2.2 - 930	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/28	13 - 5300	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/27	66 - 27000	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/28	9.6 - 4000	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**5.5 J**	**120000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**23/28**	**0.4 - 9.1**	**120000**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/28	13 - 5300	N/A	570000	C	N	ND
91-20-3	**Naphthalene**	**5.3 J**	**18000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**20/28**	**0.87 - 9.1**	**18000**	**3800**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/28	14 - 5700	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/28	12 - 4900	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/28	13 - 5300	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/28	62 - 26000	N/A	1000	C	N	ND
85-01-8	**Phenanthrene**	**5.8 J**	**480000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**27/28**	**9.1**	**480000**	**180000 (5)**	**N**	**Y**	**ASV**
108-95-2	Phenol	13 J	27 J	µg/kg	SS-138: 0-2 ft BGS (5/17/2018)	1/28	8.5 - 3500	27 J	1900000	N	N	BSV
129-00-0	**Pyrene**	**17 J**	**450000**	**µg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**26/28**	**0.68 - 9.1**	**450000**	**180000**	**N**	**Y**	**ASV**
	Metals											
7429-90-5	**Aluminum**	**1500 J**	**15000 J**	**mg/kg**	**SS-138: 0-2 ft BGS (5/17/2018)**	**28/28**	**--**	**15000 J**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.13 J**	**12 J**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**22/28**	**0.12 - 6.6**	**12 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**0.74 J**	**56**	**mg/kg**	**BH148-18: 6-8 ft BGS (5/17/2018)**	**28/28**	**--**	**56**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	9.6	420	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	28/28	--	420	1500	N	N	BSV
7440-41-7	Beryllium	0.099 J	5.2	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	28/28	--	5.2	16	N	N	BSV
7440-43-9	**Cadmium**	**0.091 J**	**15**	**mg/kg**	**BH152-18: 9-11 ft BGS (5/29/2018)**	**26/28**	**0.07 - 0.68**	**15**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	5400	410000	mg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	28/28	--	410000	--		N	NAT
16065-83-1	Chromium III (trivalent)	2.1	280	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	28/28	--	280	12000	N	N	BSV

Table 2.8

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface and Subsurface soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03-EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.31 J**	**1.7**	**mg/kg**	**TT-18: 5- ft BGS (10/1/2008)**	**16/28**	**0.25 - 1.5**	**1.7**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**0.77**	**27**	**mg/kg**	**SS-140: 0.17-2.17 ft BGS (5/17/2018)**	**28/28**	**--**	**27**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	3.5	96	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	28/28	--	96	310	N	N	BSV
57-12-5	Cyanide (total)	0.22 J	1.3	mg/kg	BH146-18: 13-15 ft BGS (5/17/2018)	8/28	0.18 - 0.68	1.3	2.3	N	N	BSV
7439-89-6	**Iron**	**1200**	**54000**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**28/28**	**--**	**54000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**2.1**	**1000**	**mg/kg**	**SS-146: 0-2 ft BGS (5/29/2018)**	**28/28**	**--**	**1000**	**400**	**C**	**Y**	**ASV**
7439-92-1	Lead - coarse fraction	33 J	100 J	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	2/2	--	100 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	50	210	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	2/2	--	210	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	36	110	mg/kg	SS-146: 0-2 ft BGS (5/29/2018)	2/2	--	110	400	C	N	BSV
7439-95-4	Magnesium	1100	65000	mg/kg	SS-147: 0-2 ft BGS (5/29/2018)	28/28	--	65000	--		N	NAT
7439-96-5	**Manganese**	**37 J**	**6000**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**28/28**	**--**	**6000**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.022 J	0.61	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	22/28	0.018 - 0.14	0.61	1.1	N	N	BSV
7440-02-0	Nickel	7.4	51	mg/kg	SS-140: 0.17-2.17 ft BGS (5/17/2018)	28/28	--	51	150	N	N	BSV
7440-09-7	Potassium	180 J	2200	mg/kg	SS-138: 0-2 ft BGS (5/17/2018)	28/28	--	2200	--		N	NAT
7782-49-2	Selenium	0.15 J	10	mg/kg	BH148-18: 6-8 ft BGS (5/17/2018)	26/28	26.6 - 27.5	10	39	N	N	BSV
7440-22-4	Silver	0.021 J	1.9	mg/kg	SS-142: 0-2 ft BGS (5/29/2018)	21/28	0.021 - 1.4	1.9	39	N	N	BSV
7440-23-5	Sodium	59 J	620	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	25/28	83 - 625	620	--		N	NAT
7440-28-0	**Thallium**	**0.083 J**	**1.5**	**mg/kg**	**BH148-18: 6-8 ft BGS (5/17/2018)**	**24/28**	**0.046 - 0.15**	**1.5**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**5.2**	**170**	**mg/kg**	**SS-147: 0-2 ft BGS (5/29/2018)**	**28/28**	**--**	**170**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	6.5	1600	mg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	28/28	--	1600	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/28	23 - 130	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/28	25 - 140	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/28	24 - 130	N/A	170	C	N	ND
53469-21-9	**Aroclor-1242 (PCB-1242)**	**980**	**980**	**µg/kg**	**BH153-18: 13-15 ft BGS (5/29/2018)**	**1/28**	**20 - 45**	**980**	**230**	**C**	**Y**	**ASV**
12672-29-6	Aroclor-1248 (PCB-1248)	59	59	µg/kg	TT-17: 14- ft BGS (9/30/2008)	1/28	25 - 140	59	230	C	N	BSV
11097-69-1	**Aroclor-1254 (PCB-1254)**	**27 J**	**1300**	**µg/kg**	**BH153-18: 13-15 ft BGS (5/29/2018)**	**7/28**	**24 - 45**	**1300**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/28	23 - 130	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	1.8 J	2.8 J	µg/kg	BH152-18: 9-11 ft BGS (5/29/2018)	4/28	1.5 - 190	2.8 J	190	C	N	BSV
72-55-9	4,4'-DDE	2.1 J	28	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	3/28	1.6 - 190	28	2000	C	N	BSV
50-29-3	4,4'-DDT	1.4 J	4.6 J	µg/kg	SS-144: 0.17-2.17 ft BGS (5/29/2018)	5/28	1.2 - 190	4.6 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/28	0.79 - 190	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/28	0.94 - 190	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	2.5 J	36	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	3/28	1.5 - 190	36	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/28	1.8 - 190	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/28	1.8 - 190	N/A	300	C	N	ND
60-57-1	Dieldrin	2.0 NJ	2.0 NJ	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	1/28	1.1 - 190	2.0 NJ	34	C	N	BSV
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/28	1.2 - 190	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	4.3 NJ	4.3 NJ	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	1/28	1.5 - 190	4.3 NJ	47000	N	N	BSV
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/28	1.3 - 190	N/A	38000	N	N	ND

Table 2.8

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU03-EU04 Surface and Subsurface soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03-EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/28	2 - 190	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	1.9 J	1.9 J	µg/kg	BH150-18: 13-15 ft BGS (5/29/2018)	1/28	1.4 - 190	1.9 J	1900	N	N	BSV
53494-70-5	Endrin ketone	1.4 NJ	21 J	µg/kg	SS-145: 0-2 ft BGS (5/29/2018)	2/28	0.92 - 190	21 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	3.8 J	3.8 J	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	1/28	1.8 - 190	3.8 J	570	C	N	BSV
5103-74-2	gamma-Chlordane	2.7 J	30 J	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	4/28	1.3 - 190	30 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/28	1.6 - 190	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	2.0 J	8.0 NJ	µg/kg	BH153-18: 13-15 ft BGS (5/29/2018)	2/28	1.5 - 190	8.0 NJ	70	C	N	BSV
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/28	6.8 - 360	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/28	26 - 7400	N/A	490	C	N	ND
	Herbicides											
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/4	21 - 27	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/4	85 - 110	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	**pg/g**	--	--	--	--	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	--	--	**pg/g**	--	--	--	--	**4.8**	**C**	**Y**	**(6)**
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/12	1	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH68-13, BH105-18, BH106-18, BH152-18, BH153-18, BH154-18, BH155-18, BH156-18, BH157-18, GP30-18, GP31-18, SS-46, SS-47, SS-48, SS-49, SS-50, SS-51, SS-52, SS-53, SS-146, SS-147, SS-149, SS-150, SS-151, SS-153, SS-169-AS, SS-170-AS, TT-8, TT-9, TT-18.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.9

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/12	0.74 - 1.6	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/7	1.3 - 1.9	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/12	1 - 2.2	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/12	0.63 - 1.3	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/12	0.82 - 1.7	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/7	0.52 - 0.76	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/7	3.3 - 4.8	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/12	0.7 - 1.5	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/7	1 - 1.5	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/12	0.7 - 1.5	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/12	0.77 - 1.6	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/7	0.74 - 1.1	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/7	0.8 - 1.2	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	5.1 J	5.3 J	µg/kg	SS-109: 0-2 ft BGS (5/30/2018)	2/12	3.4 - 6.8	5.3 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/12	3.7 - 7.9	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/12	3.4 - 7.1	N/A	3300000	N	N	ND
67-64-1	Acetone	28	180 J	µg/kg	SS-116: 0-2 ft BGS (5/30/2018)	6/12	20 - 35	180 J	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/12	0.63 - 1.3	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/12	0.62 - 1.3	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/12	2.2 - 4.6	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/12	0.9 - 1.9	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/12	1.1 - 2.2	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/12	3 - 6.3	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/12	0.83 - 1.8	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/12	1.1 - 2.3	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/12	0.72 - 1.5	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/12	0.95 - 2	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/12	0.59 - 1.3	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/12	1.3 - 2.8	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/12	1.2 - 2.6	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/12	2.5 - 5.4	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/12	0.86 - 1.8	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/12	0.95 - 2	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/12	0.76 - 1.6	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/12	3.1 - 6.5	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/12	1.1 - 2.4	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/12	0.74 - 1.6	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/12	11 - 23	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/12	1.1 - 2.2	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	1.6 J	3.5 J	µg/kg	SS-116: 0-2 ft BGS (5/30/2018)	2/12	0.66 - 1.4	3.5 J	8100	N	N	BSV
108-88-3	Toluene	1.5 J	1.5 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	1/12	0.7 - 1.4	1.5 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/12	0.42 - 0.9	N/A	160000	N	N	ND

Table 2.9

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/12	0.94 - 2	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/12	0.58 - 1.2	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/12	0.98 - 2.1	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/12	1.2 - 2.5	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/12	0.76 - 1.6	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/12	1.4 - 3.1	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/12	11 - 46	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/12	73 - 320	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/12	68 - 290	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/12	47 - 200	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/12	43 - 180	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/12	150 - 650	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/12	66 - 280	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/12	60 - 260	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/12	15 - 64	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/12	11 - 46	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	13	1200	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	12/12	--	1200	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/12	33 - 140	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/12	43 - 180	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/12	14 - 59	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/12	31 - 130	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/12	46 - 200	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/12	52 - 220	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/12	85 - 370	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/12	15 - 64	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/12	48 - 210	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/12	32 - 140	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/12	15 - 64	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/12	64 - 270	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/12	100 - 430	N/A	--		N	ND
83-32-9	Acenaphthene	6.8 J	170	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	6/12	0.87 - 3.3	170	360000	N	N	BSV
208-96-8	Acenaphthylene	5.4 J	95	µg/kg	SS-123: 0.3-2.3 ft BGS (5/31/2018)	9/12	0.44 - 18	95	360000 (5)	N	N	BSV
98-86-2	Acetophenone	12 J	95 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	4/12	12 - 50	95 J	780000	N	N	BSV
120-12-7	Anthracene	9.8 J	580	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	11/12	0.98	580	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/12	38 - 160	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	94 J	94 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	1/12	24 - 110	94 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**9.3**	**1900**	**µg/kg**	**SS-101: 0.25-2.25 ft BGS (11/2/2018)**	**12/12**	**--**	**1900**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**6.3 J**	**1600**	**µg/kg**	**SS-102: 0-2 ft BGS (5/30/2018)**	**12/12**	**--**	**1600**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**9.1**	**2100**	**µg/kg**	**SS-102: 0-2 ft BGS (5/30/2018)**	**12/12**	**--**	**2100**	**1100**	**C**	**Y**	**ASV**

Table 2.9

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	25	640	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	11/12	0.44	640	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	38	840	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	9/12	0.78 - 1	840	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	28 J	120	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	2/12	18 - 78	120	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/12	13 - 55	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/12	13 - 55	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	60 J	320	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	3/12	54 - 230	320	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/12	23 - 100	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/12	80 - 340	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**37 J**	**320**	**µg/kg**	**SS-101: 0.25-2.25 ft BGS (11/2/2018)**	**5/12**	**21 - 44**	**320**	**--**		**Y**	**AD**
218-01-9	Chrysene	48	1900	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	11/12	1.4	1900	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**22**	**200**	**µg/kg**	**SS-101: 0.25-2.25 ft BGS (11/2/2018)**	**5/12**	**0.74 - 1.6**	**200**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	21 J	290	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	8/12	15 - 20	290	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/12	33 - 140	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/12	15 - 64	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	40 J	53 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	2/12	23 - 100	53 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/12	30 - 130	N/A	63000	N	N	ND
206-44-0	Fluoranthene	22	3800	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	12/12	--	3800	240000	N	N	BSV
86-73-7	Fluorene	5.1 J	220	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	8/12	0.61 - 1.2	220	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/12	2.2 - 13	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/12	13 - 55	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/12	66 - 280	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/12	9.6 - 41	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	25	650	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	10/12	0.4 - 0.44	650	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/12	13 - 55	N/A	570000	C	N	ND
91-20-3	Naphthalene	9.5 J	740	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	12/12	--	740	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/12	14 - 59	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/12	12 - 50	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/12	13 - 55	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/12	62 - 260	N/A	1000	C	N	ND
85-01-8	Phenanthrene	19	2100	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	12/12	--	2100	180000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/12	8.5 - 37	N/A	1900000	N	N	ND
129-00-0	Pyrene	19	2900	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	12/12	--	2900	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**1600**	**9800**	**mg/kg**	**SS-109: 0-2 ft BGS (5/30/2018)**	**12/12**	**--**	**9800**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.20 J	1.2	mg/kg	SS-98: 0.17-2.17 ft BGS (5/31/2018)	10/12	0.14	1.2	3.1	N	N	BSV
7440-38-2	**Arsenic**	**5.2**	**59**	**mg/kg**	**SS-109: 0-2 ft BGS (5/30/2018)**	**12/12**	**--**	**59**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	41	350	mg/kg	SS-109: 0-2 ft BGS (5/30/2018)	12/12	--	350	1500	N	N	BSV
7440-41-7	Beryllium	0.25	4.1	mg/kg	SS-104: 0-2 ft BGS (5/30/2018)	12/12	--	4.1	16	N	N	BSV
7440-43-9	Cadmium	0.057 J	0.74	mg/kg	SS-100: 0.17-2.17 ft BGS (11/2/2018)	11/12	0.047	0.74	7.1	N	N	BSV
7440-70-2	Calcium	1900	100000	mg/kg	SS-103: 0-2 ft BGS (5/30/2018)	12/12	--	100000	--		N	NAT
16065-83-1	Chromium III (trivalent)	3.9	140	mg/kg	SS-98: 0.17-2.17 ft BGS (5/31/2018)	12/12	--	140	12000	N	N	BSV

Table 2.9

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.29 J**	**1.5**	**mg/kg**	**SS-104: 0-2 ft BGS (5/30/2018)**	**5/12**	**0.26 - 0.36**	**1.5**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**3.6**	**12**	**mg/kg**	**SS-104: 0-2 ft BGS (5/30/2018)**	**12/12**	**--**	**12**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**13**	**960**	**mg/kg**	**SS-98: 0.17-2.17 ft BGS (5/31/2018)**	**12/12**	**--**	**960**	**310**	**N**	**Y**	**ASV**
57-12-5	Cyanide (total)	0.24 J	0.79	mg/kg	SS-120: 0-2 ft BGS (5/31/2018)	7/12	0.18 - 0.31	0.79	2.3	N	N	BSV
7439-89-6	**Iron**	**4600**	**18000**	**mg/kg**	**SS-98: 0.17-2.17 ft BGS (5/31/2018)**	**12/12**	**--**	**18000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	1.7	120	mg/kg	SS-98: 0.17-2.17 ft BGS (5/31/2018)	12/12	--	120	400	C	N	BSV
7439-92-1	Lead - coarse fraction	23 J	41 J	mg/kg	SS-103: 0-2 ft BGS (5/30/2018)	2/2	--	41 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	31	310	mg/kg	SS-123: 0.3-2.3 ft BGS (5/31/2018)	3/3	--	310	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	27	37	mg/kg	SS-103: 0-2 ft BGS (5/30/2018)	2/2	--	37	400	C	N	BSV
7439-95-4	Magnesium	340	55000	mg/kg	SS-123: 0.3-2.3 ft BGS (5/31/2018)	12/12	--	55000	--		N	NAT
7439-96-5	**Manganese**	**31**	**950 J**	**mg/kg**	**SS-101: 0.25-2.25 ft BGS (11/2/2018)**	**12/12**	**--**	**950 J**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.024 J	0.5	mg/kg	SS-109: 0-2 ft BGS (5/30/2018)	11/12	0.021 - 0.024	0.5	1.1	N	N	BSV
7440-02-0	**Nickel**	**8.2**	**700**	**mg/kg**	**SS-98: 0.17-2.17 ft BGS (5/31/2018)**	**12/12**	**--**	**700**	**150**	**N**	**Y**	**ASV**
7440-09-7	Potassium	200 J	2200	mg/kg	SS-109: 0-2 ft BGS (5/30/2018)	12/12	--	2200	--		N	NAT
7782-49-2	Selenium	0.29 J	6.3	mg/kg	SS-109: 0-2 ft BGS (5/30/2018)	12/12	--	6.3	39	N	N	BSV
7440-22-4	Silver	0.031 J	0.52	mg/kg	SS-98: 0.17-2.17 ft BGS (5/31/2018)	10/12	0.024	0.52	39	N	N	BSV
7440-23-5	Sodium	68 J	290	mg/kg	SS-109: 0-2 ft BGS (5/30/2018)	12/12	--	290	--		N	NAT
7440-28-0	**Thallium**	**0.063 J**	**2.7**	**mg/kg**	**SS-109: 0-2 ft BGS (5/30/2018)**	**12/12**	**--**	**2.7**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**10**	**45**	**mg/kg**	**SS-101: 0.25-2.25 ft BGS (11/2/2018)**	**12/12**	**--**	**45**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	4.9	260	mg/kg	SS-98: 0.17-2.17 ft BGS (5/31/2018)	12/12	--	260	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/12	23 - 34	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/12	25 - 37	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/12	24 - 35	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/12	20 - 29	N/A	230	C	N	ND
12672-29-6	**Aroclor-1248 (PCB-1248)**	**400**	**400**	**µg/kg**	**SS-99: 0.25-2.25 ft BGS (11/2/2018)**	**1/12**	**25 - 37**	**400**	**230**	**C**	**Y**	**ASV**
11097-69-1	**Aroclor-1254 (PCB-1254)**	**78**	**160**	**µg/kg**	**SS-100: 0.17-2.17 ft BGS (11/2/2018)**	**3/12**	**25 - 35**	**160**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	74	74	µg/kg	SS-99: 0.25-2.25 ft BGS (11/2/2018)	1/12	23 - 34	74	240	C	N	BSV
	Pesticides											
72-54-8	4,4'-DDD	3.7 J	14	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	2/12	1.6 - 35	14	190	C	N	BSV
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/12	1.7 - 36	N/A	2000	C	N	ND
50-29-3	4,4'-DDT	1.2 J	2.0 J	µg/kg	SS-100: 0.17-2.17 ft BGS (11/2/2018)	2/12	1.3 - 27	2.0 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/12	0.85 - 18	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/12	1 - 22	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/12	1.7 - 36	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/12	1.9 - 41	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/12	1.9 - 40	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/12	1.2 - 26	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/12	1.3 - 29	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	3.7 J	3.7 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	1/12	1.6 - 35	3.7 J	47000	N	N	BSV
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/12	1.4 - 31	N/A	38000	N	N	ND

Table 2.9

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/12	2.1 - 45	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	1.8 NJ	1.8 NJ	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	1/12	1.4 - 31	1.8 NJ	1900	N	N	BSV
53494-70-5	Endrin ketone	3.6 J	3.6 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	1/12	0.98 - 21	3.6 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/12	2 - 43	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/12	1.4 - 29	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/12	1.7 - 38	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/12	1.6 - 34	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/12	7.2 - 160	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/12	28 - 600	N/A	490	C	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/3	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-98, SS-99, SS-100, SS-101, SS-102, SS-103, SS-104, SS-109, SS-112, SS-116, SS-120, SS-123, SS-158-AS, SS-159-AS, SS-160-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.10

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/21	0.7 - 2.5	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/16	1.2 - 4.4	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/21	0.97 - 3.5	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/21	0.59 - 2.1	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/21	0.77 - 2.8	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/16	0.49 - 1.8	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/16	3.1 - 11	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/21	0.66 - 2.4	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/16	0.95 - 3.4	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/21	0.66 - 2.4	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/21	0.73 - 2.6	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/16	0.7 - 2.5	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/16	0.75 - 2.7	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	3.2 J	38 J	µg/kg	BH132-18: 6.5-8.5 ft BGS (5/31/2018)	8/21	3 - 6.8	38 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/21	3.5 - 13	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/21	3.2 - 11	N/A	3300000	N	N	ND
67-64-1	Acetone	19 J	250 J	µg/kg	BH132-18: 6.5-8.5 ft BGS (5/31/2018)	12/21	18 - 35	250 J	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/21	0.6 - 2.2	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/21	0.58 - 2.1	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/21	2 - 7.4	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/21	0.84 - 3.1	N/A	680	N	N	ND
75-15-0	Carbon disulfide	2.8 J	2.8 J	µg/kg	BH122-18: 6-8 ft BGS (5/31/2018)	1/21	0.99 - 3.6	2.8 J	77000	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/21	2.8 - 10	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/21	0.78 - 2.8	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/21	1 - 3.8	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/21	0.67 - 2.4	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/21	0.89 - 3.2	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	5	5	µg/kg	BH127-18: 7-9 ft BGS (5/30/2018)	1/21	0.56 - 2	5	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/21	1.2 - 4.4	N/A	1800	C	N	ND
110-82-7	Cyclohexane	4.8 J	4.8 J	µg/kg	BH132-18: 6.5-8.5 ft BGS (5/31/2018)	1/21	1.2 - 2.6	4.8 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/21	2.4 - 8.6	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/21	0.8 - 2.9	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	3.6 J	3.6 J	µg/kg	BH132-18: 6.5-8.5 ft BGS (5/31/2018)	1/21	0.89 - 2	3.6 J	5800	C	N	BSV
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/21	0.71 - 2.6	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/21	2.9 - 11	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	6.7 J	6.7 J	µg/kg	BH132-18: 6.5-8.5 ft BGS (5/31/2018)	1/21	1 - 2.4	6.7 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/21	0.7 - 2.5	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/21	10 - 37	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/21	0.99 - 3.6	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	1.6 J	8.4	µg/kg	BH130-18: 9.5-11.5 ft BGS (5/30/2018)	4/21	0.62 - 1.4	8.4	8100	N	N	BSV
108-88-3	Toluene	1.4 J	8.9 J	µg/kg	BH132-18: 6.5-8.5 ft BGS (5/31/2018)	3/21	0.66 - 1.4	8.9 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/21	0.4 - 1.4	N/A	160000	N	N	ND

Table 2.10

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/21	0.88 - 3.2	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/21	0.54 - 2	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/21	0.92 - 3.3	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/21	1.1 - 4	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/21	0.71 - 2.6	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	16 J	16 J	µg/kg	BH132-18: 6.5-8.5 ft BGS (5/31/2018)	1/21	1.4 - 3.1	16 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/21	11 - 52	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/21	73 - 360	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/21	68 - 330	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/21	47 - 230	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/21	43 - 210	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/20	150 - 740	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/21	66 - 320	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/21	60 - 290	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/21	15 - 73	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/21	11 - 52	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	12	1200	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	19/21	0.57 - 0.59	1200	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/21	33 - 160	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/21	43 - 210	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/21	14 - 68	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/21	31 - 150	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/21	46 - 220	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/21	52 - 260	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/21	85 - 420	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/21	15 - 73	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/21	48 - 230	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/21	32 - 160	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/21	15 - 73	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/21	64 - 310	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/20	100 - 490	N/A	--		N	ND
83-32-9	Acenaphthene	6.8 J	170	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	10/21	0.83 - 3.3	170	360000	N	N	BSV
208-96-8	Acenaphthylene	4.5 J	95	µg/kg	SS-123: 0.3-2.3 ft BGS (5/31/2018)	15/21	0.4 - 18	95	360000 (5)	N	N	BSV
98-86-2	Acetophenone	12 J	95 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	5/21	12 - 57	95 J	780000	N	N	BSV
120-12-7	Anthracene	4.5 J	580	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	17/21	0.89 - 1.8	580	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/21	38 - 190	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	32 J	94 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	3/21	24 - 120	94 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**8**	**1900**	**µg/kg**	**SS-101: 0.25-2.25 ft BGS (11/2/2018)**	**20/21**	**0.72**	**1900**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**5.1 J**	**1600**	**µg/kg**	**SS-102: 0-2 ft BGS (5/30/2018)**	**21/21**	**--**	**1600**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**8.5**	**2100**	**µg/kg**	**SS-102: 0-2 ft BGS (5/30/2018)**	**21/21**	**--**	**2100**	**1100**	**C**	**Y**	**ASV**

Table 2.10

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	6.3 J	640	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	18/21	0.4 - 0.79	640	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	24	840	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	14/21	0.78 - 1.5	840	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	22 J	130 J	µg/kg	BH132-18: 6.5-8.5 ft BGS (5/31/2018)	5/21	18 - 89	130 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/21	13 - 63	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/21	13 - 63	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	60 J	320	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	5/21	54 - 270	320	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/21	23 - 110	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/21	80 - 390	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**37 J**	**320**	**µg/kg**	**SS-101: 0.25-2.25 ft BGS (11/2/2018)**	**8/21**	**21 - 99**	**320**	**--**		**Y**	**AD**
218-01-9	Chrysene	8.3	1900	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	19/21	1.3 - 1.4	1900	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**22**	**200**	**µg/kg**	**SS-101: 0.25-2.25 ft BGS (11/2/2018)**	**8/21**	**0.72 - 3.4**	**200**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	21 J	290	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	11/21	14 - 68	290	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/21	33 - 160	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/21	15 - 73	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	30 J	53 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	3/21	23 - 110	53 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/21	30 - 150	N/A	63000	N	N	ND
206-44-0	Fluoranthene	9.8	3800	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	21/21	--	3800	240000	N	N	BSV
86-73-7	Fluorene	5.1 J	220	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	12/21	0.58 - 1.2	220	240000	N	N	BSV
118-74-1	Hexachlorobenzene	36	36	µg/kg	BH125-18: 7-9 ft BGS (5/30/2018)	1/21	2.2 - 13	36	210	C	N	BSV
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/21	13 - 63	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/21	66 - 320	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/21	9.6 - 47	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	5.4 J	650	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	18/21	0.4 - 0.44	650	1100	C	N	BSV
78-59-1	Isophorone	110 J	110 J	µg/kg	BH128-18: 13-15 ft BGS (5/30/2018)	1/21	13 - 63	110 J	570000	C	N	BSV
91-20-3	Naphthalene	9.5 J	740	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	18/21	0.94 - 0.97	740	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/21	14 - 68	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/21	12 - 57	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/21	13 - 63	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	860	860	µg/kg	BH126-18: 10-12 ft BGS (5/30/2018)	1/21	62 - 300	860	1000	C	N	BSV
85-01-8	Phenanthrene	6.3 J	2100	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	21/21	--	2100	180000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/21	8.5 - 42	N/A	1900000	N	N	ND
129-00-0	Pyrene	10	2900	µg/kg	SS-101: 0.25-2.25 ft BGS (11/2/2018)	21/21	--	2900	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**1600**	**12000**	**mg/kg**	**BH127-18: 7-9 ft BGS (5/30/2018)**	**21/21**	**--**	**12000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.16 J**	**5.4 J**	**mg/kg**	**BH125-18: 7-9 ft BGS (5/30/2018)**	**18/21**	**0.14 - 0.25**	**5.4 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**4.2**	**59**	**mg/kg**	**SS-109: 0-2 ft BGS (5/30/2018)**	**21/21**	**--**	**59**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	41	1000	mg/kg	BH125-18: 7-9 ft BGS (5/30/2018)	21/21	--	1000	1500	N	N	BSV
7440-41-7	Beryllium	0.19	4.1	mg/kg	SS-104: 0-2 ft BGS (5/30/2018)	21/21	--	4.1	16	N	N	BSV
7440-43-9	Cadmium	0.057 J	0.74	mg/kg	SS-100: 0.17-2.17 ft BGS (11/2/2018)	20/21	0.047	0.74	7.1	N	N	BSV
7440-70-2	Calcium	1900	320000	mg/kg	BH128-18: 13-15 ft BGS (5/30/2018)	21/21	--	320000	--		N	NAT
16065-83-1	Chromium III (trivalent)	3.9	140	mg/kg	SS-98: 0.17-2.17 ft BGS (5/31/2018)	21/21	--	140	12000	N	N	BSV

Table 2.10

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.29 J**	**7.5 J**	**mg/kg**	**BH132-18: 6.5-8.5 ft BGS (5/31/2018)**	**9/21**	**0.26 - 0.57**	**7.5 J**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**2.4**	**12**	**mg/kg**	**SS-104: 0-2 ft BGS (5/30/2018)**	**21/21**	**--**	**12**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**9.9**	**960**	**mg/kg**	**SS-98: 0.17-2.17 ft BGS (5/31/2018)**	**21/21**	**--**	**960**	**310**	**N**	**Y**	**ASV**
57-12-5	Cyanide (total)	0.22 J	0.83	mg/kg	BH128-18: 13-15 ft BGS (5/30/2018)	11/21	0.18 - 0.31	0.83	2.3	N	N	BSV
7439-89-6	**Iron**	**4300**	**23000**	**mg/kg**	**BH127-18: 7-9 ft BGS (5/30/2018)**	**21/21**	**--**	**23000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	1.7	270	mg/kg	BH126-18: 10-12 ft BGS (5/30/2018)	21/21	--	270	400	C	N	BSV
7439-92-1	Lead - coarse fraction	23 J	41 J	mg/kg	SS-103: 0-2 ft BGS (5/30/2018)	2/2	--	41 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	31	310	mg/kg	SS-123: 0.3-2.3 ft BGS (5/31/2018)	3/3	--	310	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	27	37	mg/kg	SS-103: 0-2 ft BGS (5/30/2018)	2/2	--	37	400	C	N	BSV
7439-95-4	Magnesium	340	55000	mg/kg	SS-123: 0.3-2.3 ft BGS (5/31/2018)	21/21	--	55000	--		N	NAT
7439-96-5	**Manganese**	**31**	**1000**	**mg/kg**	**BH130-18: 9.5-11.5 ft BGS (5/30/2018)**	**21/21**	**--**	**1000**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.024 J	0.5	mg/kg	SS-109: 0-2 ft BGS (5/30/2018)	19/21	0.021 - 0.045	0.5	1.1	N	N	BSV
7440-02-0	**Nickel**	**8.2**	**700**	**mg/kg**	**SS-98: 0.17-2.17 ft BGS (5/31/2018)**	**21/21**	**--**	**700**	**150**	**N**	**Y**	**ASV**
7440-09-7	Potassium	200 J	2200	mg/kg	SS-109: 0-2 ft BGS (5/30/2018)	21/21	--	2200	--		N	NAT
7782-49-2	Selenium	0.24 J	6.3	mg/kg	SS-109: 0-2 ft BGS (5/30/2018)	20/21	0.24	6.3	39	N	N	BSV
7440-22-4	Silver	0.031 J	0.52	mg/kg	SS-98: 0.17-2.17 ft BGS (5/31/2018)	19/21	0.024	0.52	39	N	N	BSV
7440-23-5	Sodium	68 J	350	mg/kg	BH129-18: 13-15 ft BGS (5/30/2018)	21/21	--	350	--		N	NAT
7440-28-0	**Thallium**	**0.063 J**	**2.7**	**mg/kg**	**SS-109: 0-2 ft BGS (5/30/2018)**	**20/21**	**0.095**	**2.7**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**10**	**45**	**mg/kg**	**SS-101: 0.25-2.25 ft BGS (11/2/2018)**	**21/21**	**--**	**45**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	4.9	260	mg/kg	SS-98: 0.17-2.17 ft BGS (5/31/2018)	21/21	--	260	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/21	23 - 48	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/21	25 - 52	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/21	24 - 50	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/21	20 - 42	N/A	230	C	N	ND
12672-29-6	**Aroclor-1248 (PCB-1248)**	**74**	**400**	**µg/kg**	**SS-99: 0.25-2.25 ft BGS (11/2/2018)**	**2/21**	**25 - 52**	**400**	**230**	**C**	**Y**	**ASV**
11097-69-1	**Aroclor-1254 (PCB-1254)**	**54**	**160**	**µg/kg**	**SS-100: 0.17-2.17 ft BGS (11/2/2018)**	**4/21**	**25 - 50**	**160**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	74	74	µg/kg	SS-99: 0.25-2.25 ft BGS (11/2/2018)	1/21	23 - 48	74	240	C	N	BSV
	Pesticides											
72-54-8	4,4'-DDD	3.7 J	14	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	2/21	1.6 - 35	14	190	C	N	BSV
72-55-9	4,4'-DDE	2.5 J	2.5 J	µg/kg	BH122-18: 6-8 ft BGS (5/31/2018)	1/21	1.7 - 36	2.5 J	2000	C	N	BSV
50-29-3	4,4'-DDT	1.2 J	3.1 J	µg/kg	BH125-18: 7-9 ft BGS (5/30/2018)	4/21	1.3 - 27	3.1 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/21	0.85 - 18	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/21	1 - 22	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	2.3 J	2.3 J	µg/kg	BH122-18: 6-8 ft BGS (5/31/2018)	1/21	1.7 - 36	2.3 J	1700	C	N	BSV
319-85-7	beta-BHC	1.9 NJ	4.5 J	µg/kg	BH127-18: 7-9 ft BGS (5/30/2018)	2/21	1.9 - 41	4.5 J	300	C	N	BSV
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/21	1.9 - 40	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/21	1.2 - 26	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/21	1.3 - 29	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	3.7 J	3.7 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	1/21	1.6 - 35	3.7 J	47000	N	N	BSV
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/21	1.4 - 31	N/A	38000	N	N	ND

Table 2.10

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/21	2.1 - 45	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	1.8 NJ	1.8 NJ	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	1/21	1.4 - 31	1.8 NJ	1900	N	N	BSV
53494-70-5	Endrin ketone	3.6 J	3.6 J	µg/kg	SS-120: 0-2 ft BGS (5/31/2018)	1/21	0.98 - 21	3.6 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/21	2 - 43	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/21	1.4 - 29	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/21	1.7 - 38	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	2.1 J	2.1 J	µg/kg	BH122-18: 6-8 ft BGS (5/31/2018)	1/21	1.6 - 34	2.1 J	70	C	N	BSV
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/21	7.2 - 160	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/21	28 - 600	N/A	490	C	N	ND
		#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A				
	Dioxins/Furans	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A				
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/12	0.25 - 1	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH122-18 BH125-18, BH126-18, BH127-18, BH129-18, BH130-18, BH132-18, BH133-18, SS-98, SS-99, SS-100, SS-101, SS-102, SS-103, SS-104, SS-109, SS-112, SS-116, SS-120, SS-123, SS-158-AS, SS-159-AS, SS-160-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.11

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/6	0.33 - 0.98	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/5	0.37 - 1.7	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/6	0.55 - 1.3	N/A	150	N	N	ND
75-34-3	**1,1-Dichloroethane**	**4.3 J**	**4.3 J**	**µg/kg**	**SS-92: 0-2 ft BGS (10/31/2018)**	**1/6**	**0.47 - 0.72**	**4.3 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/6	0.77 - 1.1	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/5	0.34 - 0.68	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/5	0.96 - 4.3	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/6	0.5 - 0.92	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/5	0.31 - 1.3	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/6	0.41 - 0.92	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/6	0.44 - 1	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/5	0.41 - 0.97	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/5	0.5 - 1.1	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	6.6 J	41	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	2/6	1.8 - 3.7	41	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/6	0.82 - 4.9	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/6	1.3 - 4.4	N/A	3300000	N	N	ND
67-64-1	Acetone	22 J	180	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	2/6	4.3 - 22	180	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/6	0.45 - 0.83	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/6	0.47 - 0.81	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/6	0.57 - 2.9	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/6	0.84 - 1.2	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/6	0.3 - 1.4	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/6	0.35 - 3.9	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/6	0.47 - 1.1	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/6	0.54 - 1.5	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/6	0.33 - 0.94	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/6	0.54 - 1.2	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/6	0.4 - 0.78	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/6	0.37 - 1.7	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/6	0.3 - 1.6	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/6	0.43 - 3.3	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/6	0.5 - 1.1	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	2.4 J	2.4 J	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	1/6	0.38 - 1.1	2.4 J	5800	C	N	BSV
98-82-8	Isopropyl benzene	1.1 J	1.1 J	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	1/6	0.28 - 0.87	1.1 J	190000	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/6	1.7 - 4.1	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/6	0.33 - 1.5	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/6	0.38 - 0.98	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/6	0.34 - 14	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/6	0.38 - 1.4	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/6	0.52 - 0.87	N/A	8100	N	N	ND
108-88-3	Toluene	2.6 J	2.6 J	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	1/6	0.48 - 0.8	2.6 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/6	0.41 - 0.55	N/A	160000	N	N	ND

Table 2.11

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/6	0.3 - 1.2	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/6	0.56 - 0.75	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/6	0.34 - 1.3	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/6	0.69 - 1.5	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/6	0.4 - 1	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	12	12	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	1/6	0.57 - 1.6	12	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/6	10 - 570	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/6	72 - 3800	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/6	67 - 3600	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/6	46 - 2400	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/6	42 - 2200	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/6	150 - 7900	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/6	65 - 3500	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/6	59 - 3100	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/6	15 - 780	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/6	10 - 560	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	9.7 J	2900	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	6/6	--	2900	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/6	33 - 1700	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/6	42 - 2200	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/6	14 - 720	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/6	30 - 1600	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/6	45 - 2400	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/6	51 - 2700	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/0	--	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/6	84 - 4500	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/6	15 - 790	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/6	47 - 2500	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/6	31 - 1700	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/6	15 - 790	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/6	63 - 3300	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/6	99 - 5200	N/A	--		N	ND
83-32-9	Acenaphthene	87	5300	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	3/6	3 - 160	5300	360000	N	N	BSV
208-96-8	Acenaphthylene	6.6 J	60	µg/kg	SS-91: 0.5-2.5 ft BGS (10/31/2018)	3/6	4.2 - 220	60	360000 (5)	N	N	BSV
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/6	12 - 610	N/A	780000	N	N	ND
120-12-7	Anthracene	6.6 J	12000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	5/6	130	12000	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/6	38 - 2000	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/kg	--	0/6	24 - 1300	N/A	170000	N	N	ND
56-55-3	**Benzo(a)anthracene**	**34**	**27000**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**5/6**	**190**	**27000**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**35**	**17000**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**5/6**	**520**	**17000**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**56**	**25000**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**6/6**	**--**	**25000**	**1100**	**C**	**Y**	**ASV**

Table 2.11

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	20	8700	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	6/6	--	8700	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	17	9500	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	5/6	390	9500	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/kg	--	0/6	18 - 950	N/A	4700	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/6	13 - 1300	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/6	13 - 670	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	8600	8600	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	1/6	54 - 1100	8600	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/6	23 - 1200	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/6	79 - 4200	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**23 J**	**8400**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**4/6**	**21 - 1100**	**8400**	**--**		**Y**	**AD**
218-01-9	Chrysene	40	29000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	5/6	83	29000	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**8.3 J**	**2700**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**5/6**	**390**	**2700**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	41 J	2700 J	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	3/6	14 - 720	2700 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/6	33 - 1700	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/6	15 - 1000	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/kg	--	0/6	23 - 1200	N/A	630000	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/6	29 - 1600	N/A	63000	N	N	ND
206-44-0	Fluoranthene	62	65000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	6/6	--	65000	240000	N	N	BSV
86-73-7	Fluorene	62	5300	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	4/6	2.9 - 3	5300	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/6	3 - 160	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/6	13 - 670	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/6	65 - 3500	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/6	9.4 - 540	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**14 J**	**7600**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**5/6**	**410**	**7600**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	44 J	44 J	µg/kg	SS-93: 0-2 ft BGS (10/31/2018)	1/6	13 - 790	44 J	570000	C	N	BSV
91-20-3	Naphthalene	13 J	760 J	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	6/6	--	760 J	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/6	14 - 720	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/6	12 - 610	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/6	13 - 1300	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/6	61 - 3200	N/A	1000	C	N	ND
85-01-8	Phenanthrene	44	52000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	6/6	--	52000	180000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/6	8.4 - 450	N/A	1900000	N	N	ND
129-00-0	Pyrene	63	50000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	6/6	--	50000	180000	N	N	BSV
	Metals											
7429-90-5	Aluminum	4600	7000	mg/kg	SS-92: 0-2 ft BGS (10/31/2018)	6/6	--	7000	7700	N	N	BSV
7440-36-0	Antimony	0.21 J	0.7	mg/kg	SS-93: 0-2 ft BGS (10/31/2018)	6/6	--	0.7	3.1	N	N	BSV
7440-38-2	**Arsenic**	**4.1**	**15**	**mg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**6/6**	**--**	**15**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	55	280	mg/kg	SS-93: 0-2 ft BGS (10/31/2018)	6/6	--	280	1500	N	N	BSV
7440-41-7	Beryllium	0.49	1.2	mg/kg	SS-86: 0-2 ft BGS (11/2/2017)	6/6	--	1.2	16	N	N	BSV
7440-43-9	Cadmium	0.24	1.6	mg/kg	SS-92: 0-2 ft BGS (10/31/2018)	6/6	--	1.6	7.1	N	N	BSV
7440-70-2	Calcium	58000	110000	mg/kg	SS-90: 0.17-2.17 ft BGS (10/31/2018)	6/6	--	110000	--		N	NAT
16065-83-1	Chromium III (trivalent)	11	57	mg/kg	SS-90: 0.17-2.17 ft BGS (10/31/2018)	6/6	--	57	12000	N	N	BSV

Table 2.11

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.42 J**	**1.9**	**mg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**2/6**	**0.26 - 0.28**	**1.9**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**3.5**	**6.8**	**mg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**6/6**	**--**	**6.8**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**20**	**3700**	**mg/kg**	**SS-90: 0.17-2.17 ft BGS (10/31/2018)**	**6/6**	**--**	**3700**	**310**	**N**	**Y**	**ASV**
57-12-5	Cyanide (total)	0.23 J	0.23 J	mg/kg	SS-93: 0-2 ft BGS (10/31/2018)	1/6	0.19 - 0.51	0.23 J	2.3	N	N	BSV
7439-89-6	**Iron**	**11000**	**24000**	**mg/kg**	**SS-91: 0.5-2.5 ft BGS (10/31/2018)**	**6/6**	**--**	**24000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	28	310	mg/kg	SS-92: 0-2 ft BGS (10/31/2018)	6/6	--	310	400	C	N	BSV
7439-95-4	Magnesium	24000	41000	mg/kg	SS-90: 0.17-2.17 ft BGS (10/31/2018)	6/6	--	41000	--		N	NAT
7439-96-5	**Manganese**	**230**	**560**	**mg/kg**	**SS-91: 0.5-2.5 ft BGS (10/31/2018)**	**6/6**	**--**	**560**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.029 J	0.17	mg/kg	SS-92: 0-2 ft BGS (10/31/2018)	6/6	--	0.17	1.1	N	N	BSV
7440-02-0	Nickel	10	47	mg/kg	SS-90: 0.17-2.17 ft BGS (10/31/2018)	6/6	--	47	150	N	N	BSV
7440-09-7	Potassium	560	960	mg/kg	SS-86: 0-2 ft BGS (11/2/2017)	6/6	--	960	--		N	NAT
7782-49-2	Selenium	0.33 J	1.4	mg/kg	SS-86: 0-2 ft BGS (11/2/2017)	6/6	--	1.4	39	N	N	BSV
7440-22-4	Silver	0.040 J	0.81	mg/kg	SS-90: 0.17-2.17 ft BGS (10/31/2018)	6/6	--	0.81	39	N	N	BSV
7440-23-5	Sodium	110 J	170 J	mg/kg	SS-92: 0-2 ft BGS (10/31/2018)	5/6	130	170 J	--		N	NAT
7440-28-0	**Thallium**	**0.10 J**	**0.53**	**mg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**6/6**	**--**	**0.53**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**16**	**60**	**mg/kg**	**SS-90: 0.17-2.17 ft BGS (10/31/2018)**	**6/6**	**--**	**60**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	59	1000	mg/kg	SS-90: 0.17-2.17 ft BGS (10/31/2018)	6/6	--	1000	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/6	23 - 240	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/6	25 - 270	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/6	19 - 260	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/6	20 - 210	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/6	20 - 270	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**41 J**	**170**	**µg/kg**	**SS-91: 0.5-2.5 ft BGS (10/31/2018)**	**2/6**	**24 - 260**	**170**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/6	21 - 240	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/6	1.5 - 33	N/A	190	C	N	ND
72-55-9	4,4'-DDE	2.7 J	2.7 J	µg/kg	SS-91: 0.5-2.5 ft BGS (10/31/2018)	1/6	1.6 - 34	2.7 J	2000	C	N	BSV
50-29-3	4,4'-DDT	1.7 J	4.7 J	µg/kg	SS-91: 0.5-2.5 ft BGS (10/31/2018)	2/6	1.2 - 25	4.7 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/6	0.81 - 17	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/6	0.95 - 20	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/6	1.6 - 33	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/6	1.8 - 39	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/6	1.8 - 38	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/6	1.2 - 24	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/6	1.3 - 27	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/6	1.5 - 33	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/6	1.3 - 28	N/A	38000	N	N	ND

Table 2.11

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/6	2 - 42	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	1.6 J	4.1 J	µg/kg	SS-87: 0.5-2.5 ft BGS (10/31/2018)	1/6	1.4 - 29	4.1 J	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/6	0.93 - 20	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/6	1.9 - 40	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	1.8 J	1.8 J	µg/kg	SS-91: 0.5-2.5 ft BGS (10/31/2018)	1/6	1.3 - 27	1.8 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/6	1.7 - 35	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/6	1.5 - 32	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/6	6.9 - 150	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/6	26 - 560	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	15	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/1	16	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/1	55	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	**pg/g**	--	--	--	--	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	--	--	**pg/g**	--	--	--	--	**4.8**	**C**	**Y**	**(6)**
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/2	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-86, SS-87, SS-88, SS-89, SS-90, SS-91, SS-92, SS-93, SS-161-AS, SS-162-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.12

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/11	0.21 - 4.7	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/10	0.24 - 4.7	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/11	0.35 - 4.7	N/A	150	N	N	ND
75-34-3	**1,1-Dichloroethane**	**4.3 J**	**4.3 J**	**µg/kg**	**SS-92: 0-2 ft BGS (10/31/2018)**	**1/11**	**0.3 - 4.7**	**4.3 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/11	0.49 - 4.7	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/10	0.22 - 4.7	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/10	0.62 - 9.4	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/11	0.32 - 4.7	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/10	0.2 - 4.7	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/11	0.26 - 4.7	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/11	0.28 - 4.7	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/10	0.26 - 4.7	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/10	0.32 - 4.7	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	1.4 J	41	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	4/11	1.8 - 19	41	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/11	0.52 - 19	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/11	0.81 - 19	N/A	3300000	N	N	ND
67-64-1	Acetone	22 J	180	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	2/11	4.3 - 22	180	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/11	0.29 - 4.7	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/11	0.3 - 4.7	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/11	0.36 - 4.7	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/11	0.53 - 4.7	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/11	0.19 - 4.7	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/11	0.23 - 4.7	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/11	0.3 - 4.7	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/11	0.34 - 4.7	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/11	0.21 - 4.7	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/11	0.34 - 4.7	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/11	0.25 - 4.7	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/11	0.24 - 4.7	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/11	0.19 - 9.4	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/11	0.27 - 4.7	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/11	0.32 - 4.7	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	2.4 J	2.4 J	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	1/11	0.24 - 4.7	2.4 J	5800	C	N	BSV
98-82-8	Isopropyl benzene	1.1 J	1.1 J	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	1/11	0.18 - 4.7	1.1 J	190000	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/11	1.1 - 9.4	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/11	0.21 - 9.4	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/11	0.24 - 19	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/11	0.34 - 14	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/11	0.24 - 4.7	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/11	0.33 - 4.7	N/A	8100	N	N	ND
108-88-3	Toluene	2.6 J	2.6 J	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	1/11	0.31 - 4.7	2.6 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/11	0.34 - 4.7	N/A	160000	N	N	ND

Table 2.12

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/11	0.19 - 4.7	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/11	0.37 - 4.7	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/11	0.22 - 4.7	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/11	0.44 - 4.7	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/11	0.25 - 4.7	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	12	12	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	1/11	0.36 - 9.4	12	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/11	10 - 1100	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/11	29 - 3800	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/11	10 - 3600	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/11	23 - 2400	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/11	23 - 2200	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/11	25 - 7900	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/11	20 - 3500	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/11	25 - 3100	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/11	0.53 - 780	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/11	9.6 - 560	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	9.7 J	2900	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	9/11	7 - 74	2900	240000	N	N	BSV
95-48-7	2-Methylphenol	13 J	13 J	µg/kg	TP-17: 8-10 ft BGS (11/2/2017)	1/11	13 - 2200	13 J	320000	N	N	BSV
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/11	11 - 2200	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/11	9.7 - 720	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/9	23 - 1600	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/11	21 - 2400	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/11	19 - 2700	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/2	210 - 2200	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/11	11 - 4500	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/11	15 - 790	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/11	25 - 2500	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/11	20 - 1700	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/11	15 - 790	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/11	31 - 3300	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/11	20 - 5200	N/A	--		N	ND
83-32-9	Acenaphthene	7.1	5300	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	6/11	0.89 - 160	5300	360000	N	N	BSV
208-96-8	Acenaphthylene	4.4 J	60	µg/kg	SS-91: 0.5-2.5 ft BGS (10/31/2018)	5/11	0.41 - 220	60	360000 (5)	N	N	BSV
98-86-2	Acetophenone	96 J	96 J	µg/kg	TP-17: 8-10 ft BGS (11/2/2017)	1/11	11 - 1100	96 J	780000	N	N	BSV
120-12-7	Anthracene	5.3 J	12000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	10/11	130	12000	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/11	11 - 2200	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	95 J	95 J	µg/kg	TP-17: 8-10 ft BGS (11/2/2017)	1/11	14 - 1300	95 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**34**	**27000**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**10/11**	**190**	**27000**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**35**	**17000**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**10/11**	**520**	**17000**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**56**	**25000**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**11/11**	**--**	**25000**	**1100**	**C**	**Y**	**ASV**

Table 2.12

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	20	8700	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	11/11	--	8700	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	17	9500	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	10/11	390	9500	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	6.0 J	64	µg/kg	TP-17: 8-10 ft BGS (11/2/2017)	2/11	4.1 - 950	64	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/11	13 - 1300	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/11	2.3 - 1100	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	57 J	8600	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	2/11	22 - 1100	8600	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/11	12 - 1200	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/11	43 - 4200	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**23 J**	**8400**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**6/11**	**21 - 1100**	**8400**	**--**		**Y**	**AD**
218-01-9	Chrysene	40	29000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	10/11	83	29000	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**8.3 J**	**2700**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**8/11**	**7 - 390**	**2700**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	26 J	2700 J	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	5/11	0.78 - 720	2700 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/11	19 - 1700	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/11	15 - 1000	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/kg	--	0/11	18 - 1200	N/A	630000	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/11	9.3 - 1600	N/A	63000	N	N	ND
206-44-0	Fluoranthene	57	65000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	11/11	--	65000	240000	N	N	BSV
86-73-7	Fluorene	45	5300	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	6/11	0.62 - 74	5300	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/11	2.5 - 160	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/11	6.6 - 670	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/11	9.5 - 3700	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/11	9.4 - 550	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**14 J**	**7600**	**µg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**10/11**	**410**	**7600**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	44 J	44 J	µg/kg	SS-93: 0-2 ft BGS (10/31/2018)	1/11	13 - 790	44 J	570000	C	N	BSV
91-20-3	Naphthalene	11	760 J	µg/kg	SS-92: 0-2 ft BGS (10/31/2018)	9/11	7 - 74	760 J	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/11	2.6 - 1100	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/11	7.4 - 610	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/11	13 - 1300	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/11	11 - 3200	N/A	1000	C	N	ND
85-01-8	Phenanthrene	41	52000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	11/11	--	52000	180000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/11	8.4 - 550	N/A	1900000	N	N	ND
129-00-0	Pyrene	51	50000	µg/kg	SS-86: 0-2 ft BGS (11/2/2017)	11/11	--	50000	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**3100 J**	**9300**	**mg/kg**	**BH120-18: 8-10 ft BGS (1/19/2018)**	**11/11**	**--**	**9300**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.21 J	3	mg/kg	BH121-18: 8-10 ft BGS (1/19/2018)	10/11	0.18	3	3.1	N	N	BSV
7440-38-2	**Arsenic**	**4.1**	**16**	**mg/kg**	**BH121-18: 8-10 ft BGS (1/19/2018)**	**11/11**	**--**	**16**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	35.8	280	mg/kg	SS-93: 0-2 ft BGS (10/31/2018)	11/11	--	280	1500	N	N	BSV
7440-41-7	Beryllium	0.37	2.3	mg/kg	BH121-18: 8-10 ft BGS (1/19/2018)	10/11	0.52	2.3	16	N	N	BSV
7440-43-9	Cadmium	0.21 J	2.6	mg/kg	BH121-18: 8-10 ft BGS (1/19/2018)	11/11	--	2.6	7.1	N	N	BSV
7440-70-2	Calcium	46000	140000	mg/kg	TP-17: 8-10 ft BGS (11/2/2017)	11/11	--	140000	--		N	NAT
16065-83-1	Chromium III (trivalent)	5.5	89	mg/kg	BH121-18: 8-10 ft BGS (1/19/2018)	11/11	--	89	12000	N	N	BSV

Table 2.12

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.42 J**	**1.9**	**mg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**5/11**	**0.26 - 1.4**	**1.9**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**3.5**	**9.8**	**mg/kg**	**BH121-18: 8-10 ft BGS (1/19/2018)**	**11/11**	**--**	**9.8**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**12**	**4700**	**mg/kg**	**BH121-18: 8-10 ft BGS (1/19/2018)**	**11/11**	**--**	**4700**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.23 J**	**7.1**	**mg/kg**	**BH121-18: 8-10 ft BGS (1/19/2018)**	**3/10**	**0.088 - 0.52**	**7.1**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**6900**	**59000**	**mg/kg**	**BH121-18: 8-10 ft BGS (1/19/2018)**	**11/11**	**--**	**59000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**12.5**	**680**	**mg/kg**	**BH121-18: 8-10 ft BGS (1/19/2018)**	**11/11**	**--**	**680**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	19000	41000	mg/kg	SS-90: 0.17-2.17 ft BGS (10/31/2018)	11/11	--	41000	--		N	NAT
7439-96-5	**Manganese**	**230**	**810**	**mg/kg**	**BH120-18: 8-10 ft BGS (1/19/2018)**	**11/11**	**--**	**810**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.027 J	0.26	mg/kg	TP-17: 8-10 ft BGS (11/2/2017)	10/11	0.1	0.26	1.1	N	N	BSV
7440-02-0	Nickel	8.1	47	mg/kg	SS-90: 0.17-2.17 ft BGS (10/31/2018)	11/11	--	47	150	N	N	BSV
7440-09-7	Potassium	390	1100	mg/kg	BH120-18: 8-10 ft BGS (1/19/2018)	11/11	--	1100	--		N	NAT
7782-49-2	Selenium	0.33 J	1.4	mg/kg	SS-86: 0-2 ft BGS (11/2/2017)	9/11	26.1 - 27.7	1.4	39	N	N	BSV
7440-22-4	Silver	0.040 J	0.81	mg/kg	SS-90: 0.17-2.17 ft BGS (10/31/2018)	9/11	1 - 1.1	0.81	39	N	N	BSV
7440-23-5	Sodium	78 J	240	mg/kg	BH121-18: 8-10 ft BGS (1/19/2018)	7/11	130 - 554	240	--		N	NAT
7440-28-0	**Thallium**	**0.10 J**	**0.53**	**mg/kg**	**SS-86: 0-2 ft BGS (11/2/2017)**	**10/11**	**0.1**	**0.53**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**12.3**	**60**	**mg/kg**	**SS-90: 0.17-2.17 ft BGS (10/31/2018)**	**11/11**	**--**	**60**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	38	2000	mg/kg	BH121-18: 8-10 ft BGS (1/19/2018)	11/11	--	2000	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/11	23 - 240	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/11	25 - 270	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/11	19 - 260	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/11	20 - 210	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/11	20 - 270	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**41 J**	**170**	**µg/kg**	**SS-91: 0.5-2.5 ft BGS (10/31/2018)**	**3/11**	**17 - 260**	**170**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/11	21 - 240	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	20 J	20 J	µg/kg	TP-17: 8-10 ft BGS (11/2/2017)	1/10	1.5 - 33	20 J	190	C	N	BSV
72-55-9	4,4'-DDE	2.7 J	2.7 J	µg/kg	SS-91: 0.5-2.5 ft BGS (10/31/2018)	1/10	1.4 - 34	2.7 J	2000	C	N	BSV
50-29-3	4,4'-DDT	1.7 J	4.7 J	µg/kg	SS-91: 0.5-2.5 ft BGS (10/31/2018)	2/10	1.2 - 25	4.7 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/10	0.81 - 18	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/10	0.95 - 20	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/10	1.6 - 33	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/10	1.8 - 39	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/10	1.6 - 38	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/10	1.1 - 24	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/10	1.3 - 27	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/10	1.5 - 33	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/10	1.3 - 28	N/A	38000	N	N	ND

Table 2.12

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/10	1.7 - 42	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	1.6 J	4.1 J	µg/kg	SS-87: 0.5-2.5 ft BGS (10/31/2018)	1/10	1.4 - 29	4.1 J	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/10	0.93 - 20	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/10	1.9 - 40	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	1.8 J	1.8 J	µg/kg	SS-91: 0.5-2.5 ft BGS (10/31/2018)	1/10	1.3 - 27	1.8 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/10	0.94 - 35	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/10	1.5 - 32	N/A	70	C	N	ND
72-43-5	Methoxychlor	1.8 NJ	1.8 NJ	µg/kg	BH121-18: 8-10 ft BGS (1/19/2018)	1/10	1.4 - 150	1.8 NJ	32000	N	N	BSV
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/10	26 - 700	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	15	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/2	16 - 21	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/2	55 - 84	N/A	70000	N	N	ND
	Dioxins/Furans											
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ND	ND	pg/g	--	0/1	1.2	N/A	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	19	19	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	19	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	0.80 J	0.80 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.80 J	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	2.7 J	2.7 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	2.7 J	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ND	ND	pg/g	--	0/1	0.18	N/A	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.35 J	0.35 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.35 J	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.18 J	0.18 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.18 J	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.20 J	0.20 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.20 J	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.38 J	0.38 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.38 J	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/1	0.09	N/A	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.36 J	0.36 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.36 J	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ND	ND	pg/g	--	0/1	0.082	N/A	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.26 J	0.26 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.26 J	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.20 J	0.20 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.20 J	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.21 J	0.21 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.21 J	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.38 J	0.38 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.38 J	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.081 J	0.081 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	0.081 J	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	1.7 J	1.7 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	1.7 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	5.2 J	5.2 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	5.2 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	4.4 J	4.4 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	4.4 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	3.7 J	3.7 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	3.7 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	7.7 J	7.7 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	7.7 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	8.9 J	8.9 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	8.9 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	8.5 J	8.5 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	8.5 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	2.8 J	2.8 J	pg/g	TP-17: 8-10 ft BGS (11/2/2017)	1/1	--	2.8 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**0.6497**	**0.6497**	**pg/g**	**TP-17: 8-10 ft BGS (11/2/2017)**	**1/1**	**--**	**0.6497**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**0.65636**	**0.65636**	**pg/g**	**TP-17: 8-10 ft BGS (11/2/2017)**	**1/1**	**--**	**0.65636**	**4.8**	**C**	**Y**	**(6)**

Table 2.12

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU09 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos										
1332-21-4	Asbestos	ND	ND	%	--	0/4	0.25 - 1	N/A	--	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH120-18, BH121-18, SS-86, SS-87, SS-88, SS-89, SS-90, SS-91, SS-92, SS-93, SS-161-AS, SS-162-AS, TP-17, TT-13, VAS-21B.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.13

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPC) in EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/8	0.74 - 0.99	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/6	1.3 - 1.7	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/7	1 - 1.3	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/8	0.63 - 0.84	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/8	0.82 - 1.1	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/6	0.52 - 0.68	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/6	3.3 - 4.3	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/7	0.7 - 0.91	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/6	1 - 1.3	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/8	0.7 - 0.93	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/8	0.77 - 1	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/6	0.74 - 0.97	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/6	0.8 - 1	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	13 J	19	µg/kg	SS-82: 0-2 ft BGS (10/31/2018)	3/8	3.5 - 4.3	19	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/7	3.7 - 4.8	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/7	3.4 - 4.4	N/A	3300000	N	N	ND
67-64-1	Acetone	23 J	100	µg/kg	SS-82: 0-2 ft BGS (10/31/2018)	5/8	21 - 25	100	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/8	0.63 - 0.84	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/8	0.61 - 0.82	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/7	2.2 - 2.8	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/8	0.89 - 1.2	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/8	1 - 1.4	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/8	2.9 - 3.9	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/7	0.83 - 1.1	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/8	1.1 - 1.5	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/8	0.71 - 0.95	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/8	0.94 - 1.3	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.93 J	0.93 J	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	1/8	0.59 - 0.77	0.93 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/8	1.3 - 1.7	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/8	1.2 - 1.7	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/7	2.5 - 3.3	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/8	0.85 - 1.1	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/7	0.95 - 1.2	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/7	0.75 - 0.99	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/8	3.1 - 4.1	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/8	1.1 - 1.5	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/8	0.74 - 0.99	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/8	11 - 14	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/7	1 - 1.4	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/7	0.66 - 0.87	N/A	8100	N	N	ND
108-88-3	Toluene	1.7 J	1.7 J	µg/kg	SS-84: 0-2 ft BGS (10/31/2018)	1/7	0.7 - 0.92	1.7 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/8	0.42 - 0.56	N/A	160000	N	N	ND

Table 2.13

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPC) in EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/7	0.93 - 1.2	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/8	0.57 - 0.76	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/8	0.97 - 1.3	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/8	1.2 - 1.5	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/8	0.76 - 1	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	1.5 J	1.5 J	µg/kg	SS-84: 0-2 ft BGS (10/31/2018)	1/7	1.4 - 1.9	1.5 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/8	10 - 22	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/8	71 - 150	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/8	66 - 140	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/8	45 - 95	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/8	41 - 87	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/8	150 - 310	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/8	64 - 130	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/8	58 - 120	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/8	14 - 30	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/8	10 - 22	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	26	770	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	8/8	--	770	240000	N	N	BSV
95-48-7	2-Methylphenol	84 J	84 J	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	1/8	32 - 67	84 J	320000	N	N	BSV
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/8	41 - 87	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/8	13 - 28	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	210 J	210 J	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	1/8	30 - 63	210 J	320000 (5)	N	N	BSV
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/8	44 - 93	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/8	51 - 110	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/8	83 - 170	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/8	14 - 30	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/8	47 - 98	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/8	31 - 65	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/8	14 - 30	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/8	62 - 130	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/8	97 - 200	N/A	--		N	ND
83-32-9	Acenaphthene	17	54	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	4/8	3.1 - 3.5	54	360000	N	N	BSV
208-96-8	Acenaphthylene	13 J	140	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	6/8	4.5 - 4.6	140	360000 (5)	N	N	BSV
98-86-2	Acetophenone	64 J	79 J	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/8	11 - 24	79 J	780000	N	N	BSV
120-12-7	Anthracene	8.8 J	270	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/8	--	270	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/8	37 - 78	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	69 J	110 J	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/8	24 - 50	110 J	170000	N	N	BSV
56-55-3	Benzo(a)anthracene	24	970	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/8	--	970	1100	C	N	BSV
50-32-8	**Benzo(a)pyrene**	**28**	**840**	**µg/kg**	**SS-83: 0-2 ft BGS (10/31/2018)**	**8/8**	**--**	**840**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**61**	**1300**	**µg/kg**	**SS-83: 0-2 ft BGS (10/31/2018)**	**8/8**	**--**	**1300**	**1100**	**C**	**Y**	**ASV**

Table 2.13

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPC) in EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	33	530	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/8	--	530	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	21	450	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/8	--	450	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	26 J	110	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	3/8	18 - 37	110	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/8	12 - 26	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/8	12 - 26	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	73 J	110	µg/kg	SS-32: 0.25-2.25 ft BGS (10/31/2018)	2/8	56 - 110	110	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/8	23 - 48	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/8	78 - 160	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**33 J**	**280**	**µg/kg**	**SS-83: 0-2 ft BGS (10/31/2018)**	**4/8**	**21 - 23**	**280**	**--**		**Y**	**AD**
218-01-9	Chrysene	38	870	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/8	--	870	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**11 J**	**150**	**µg/kg**	**SS-83: 0-2 ft BGS (10/31/2018)**	**8/8**	**--**	**150**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	17 J	270	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	7/8	14	270	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/8	32 - 67	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/8	14 - 30	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/kg	--	0/8	23 - 48	N/A	630000	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/8	29 - 61	N/A	63000	N	N	ND
206-44-0	Fluoranthene	41	2100	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/8	--	2100	240000	N	N	BSV
86-73-7	Fluorene	12 J	120	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	5/8	3 - 3.4	120	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/8	2.9 - 6.2	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/8	12 - 26	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/8	64 - 130	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/8	9.3 - 20	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	32	490	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/8	--	490	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/8	12 - 26	N/A	570000	C	N	ND
91-20-3	Naphthalene	25	460	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	8/8	--	460	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/8	13 - 28	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/8	11 - 24	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/8	12 - 26	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/8	60 - 130	N/A	1000	C	N	ND
85-01-8	Phenanthrene	46	1300	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/8	--	1300	180000 (5)	N	N	BSV
108-95-2	Phenol	12 J	180	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/8	8.3 - 17	180	1900000	N	N	BSV
129-00-0	Pyrene	30	1500	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/8	--	1500	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**2400**	**12000**	**mg/kg**	**SS-79: 0-2 ft BGS (10/31/2018)**	**8/8**	**--**	**12000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.25 J	0.88	mg/kg	SS-80: 0-2 ft BGS (10/31/2018)	7/8	0.1	0.88	3.1	N	N	BSV
7440-38-2	**Arsenic**	**4**	**27**	**mg/kg**	**SS-79: 0-2 ft BGS (10/31/2018)**	**8/8**	**--**	**27**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	20	690	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	8/8	--	690	1500	N	N	BSV
7440-41-7	Beryllium	0.33	2.8	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	8/8	--	2.8	16	N	N	BSV
7440-43-9	Cadmium	0.13 J	0.94	mg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	8/8	--	0.94	7.1	N	N	BSV
7440-70-2	Calcium	18000	140000	mg/kg	SS-32: 0.25-2.25 ft BGS (10/31/2018)	8/8	--	140000	--		N	NAT
16065-83-1	Chromium III (trivalent)	6.2	80	mg/kg	SS-82: 0-2 ft BGS (10/31/2018)	8/8	--	80	12000	N	N	BSV

Table 2.13

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPC) in EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.42 J**	**0.44 J**	**mg/kg**	**SS-84: 0-2 ft BGS (10/31/2018)**	**2/8**	**0.25 - 0.3**	**0.44 J**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**2.6**	**8.9**	**mg/kg**	**SS-79: 0-2 ft BGS (10/31/2018)**	**8/8**	**--**	**8.9**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	8.1	90	mg/kg	SS-80: 0-2 ft BGS (10/31/2018)	8/8	--	90	310	N	N	BSV
57-12-5	Cyanide (total)	0.23 J	0.35 J	mg/kg	SS-82: 0-2 ft BGS (10/31/2018)	3/8	0.2 - 0.23	0.35 J	2.3	N	N	BSV
7439-89-6	**Iron**	**7400**	**27000**	**mg/kg**	**SS-82: 0-2 ft BGS (10/31/2018)**	**8/8**	**--**	**27000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	4.5	140	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	8/8	--	140	400	C	N	BSV
7439-92-1	Lead - coarse fraction	44 J	52 J	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/2	--	52 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	74	99	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/2	--	99	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	48	64	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/2	--	64	400	C	N	BSV
7439-95-4	Magnesium	5700	43000	mg/kg	SS-32: 0.25-2.25 ft BGS (10/31/2018)	8/8	--	43000	--		N	NAT
7439-96-5	**Manganese**	**210**	**550**	**mg/kg**	**SS-82: 0-2 ft BGS (10/31/2018)**	**8/8**	**--**	**550**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.024 J	0.27	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	7/8	0.021	0.27	1.1	N	N	BSV
7440-02-0	Nickel	7.4	31	mg/kg	SS-82: 0-2 ft BGS (10/31/2018)	8/8	--	31	150	N	N	BSV
7440-09-7	Potassium	510	1000	mg/kg	SS-78: 0-2 ft BGS (10/31/2018)	8/8	--	1000	--		N	NAT
7782-49-2	Selenium	0.32 J	1.1	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	8/8	--	1.1	39	N	N	BSV
7440-22-4	Silver	0.053 J	0.23	mg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	7/8	0.018	0.23	39	N	N	BSV
7440-23-5	Sodium	91 J	640	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	8/8	--	640	--		N	NAT
7440-28-0	**Thallium**	**0.10 J**	**0.38**	**mg/kg**	**SS-80: 0-2 ft BGS (10/31/2018)**	**8/8**	**--**	**0.38**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	9.4	36	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	8/8	--	36	39	N	N	BSV
7440-66-6	Zinc	31	180	mg/kg	SS-80: 0-2 ft BGS (10/31/2018)	8/8	--	180	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/8	22 - 27	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/8	24 - 29	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/8	23 - 28	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/8	19 - 23	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/8	24 - 29	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**40 J**	**760 J**	**µg/kg**	**SS-84: 0-2 ft BGS (10/31/2018)**	**4/8**	**23 - 28**	**760 J**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/8	22 - 27	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	4.3 J	4.3 J	µg/kg	SS-78: 0-2 ft BGS (10/31/2018)	1/8	1.5 - 18	4.3 J	190	C	N	BSV
72-55-9	4,4'-DDE	5.2 J	30	µg/kg	SS-84: 0-2 ft BGS (10/31/2018)	2/8	1.5 - 18	30	2000	C	N	BSV
50-29-3	4,4'-DDT	2.9 J	13 J	µg/kg	SS-84: 0-2 ft BGS (10/31/2018)	3/8	1.2 - 14	13 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/8	0.78 - 9.4	N/A	39	C	N	ND
319-84-6	alpha-BHC	1.9 J	13 J	µg/kg	SS-80: 0-2 ft BGS (10/31/2018)	2/8	0.93 - 11	13 J	86	C	N	BSV
5103-71-9	alpha-Chlordane	1.7 J	1.7 J	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	1/8	1.5 - 18	1.7 J	1700	C	N	BSV
319-85-7	beta-BHC	2.2 J	7.3 J	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	3/8	1.8 - 21	7.3 J	300	C	N	BSV
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/8	1.7 - 21	N/A	300	C	N	ND
60-57-1	**Dieldrin**	**3.3 J**	**37 J**	**µg/kg**	**SS-81: 0.33-2.33 ft BGS (10/31/2018)**	**2/8**	**1.1 - 13**	**37 J**	**34**	**C**	**Y**	**ASV**
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/8	1.2 - 15	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/8	1.5 - 18	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/8	1.3 - 16	N/A	38000	N	N	ND

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Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPC) in EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/8	1.9 - 23	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	2.4 J	2.4 J	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	1/8	1.3 - 16	2.4 J	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/8	0.91 - 11	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/8	1.8 - 22	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	1.8 J	1.8 J	µg/kg	SS-78: 0-2 ft BGS (10/31/2018)	2/8	1.3 - 15	1.8 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/8	1.6 - 19	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	4.2 J	4.2 J	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	1/8	1.5 - 18	4.2 J	70	C	N	BSV
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/8	6.7 - 80	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/8	25 - 310	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	14	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/1	15	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/1	54	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/1	0.25	N/A	--		N	ND
12001-29-5	Chrysotile asbestos	ND	ND	%	--	0/1	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-32, SS-78, SS-79, SS-80, SS-81, SS-82, SS-83, SS-84, SS-85, SS-163-AS, SS-164-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.14

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Subsurface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/12	0.2 - 0.99	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/10	0.23 - 1.7	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/11	0.34 - 1.3	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/12	0.29 - 0.84	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/12	0.48 - 1.1	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/10	0.21 - 0.68	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/10	0.6 - 4.3	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/11	0.31 - 0.91	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/10	0.19 - 1.3	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/12	0.26 - 0.93	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/12	0.27 - 1	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/10	0.26 - 0.97	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/10	0.31 - 1	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	3.1 J	19	µg/kg	SS-82: 0-2 ft BGS (10/31/2018)	5/12	1.1 - 4.3	19	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/11	0.51 - 4.8	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/11	0.79 - 4.4	N/A	3300000	N	N	ND
67-64-1	Acetone	17 J	100	µg/kg	SS-82: 0-2 ft BGS (10/31/2018)	7/12	8.8 - 25	100	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/12	0.28 - 0.84	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/12	0.29 - 0.82	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/11	0.35 - 2.8	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/12	0.52 - 1.2	N/A	680	N	N	ND
75-15-0	Carbon disulfide	0.34 J	0.38 J	µg/kg	BH118-18: 3-5 ft BGS (1/18/2018)	1/12	0.19 - 1.4	0.38 J	77000	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/12	0.22 - 3.9	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/11	0.29 - 1.1	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/12	0.34 - 1.5	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/12	0.2 - 0.95	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/12	0.34 - 1.3	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.93 J	0.93 J	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	1/12	0.25 - 0.77	0.93 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/12	0.23 - 1.7	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/12	0.19 - 1.7	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/11	0.27 - 3.3	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/12	0.31 - 1.1	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/11	0.24 - 1.2	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/11	0.18 - 0.99	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/12	1 - 4.1	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/12	0.2 - 1.5	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/12	0.24 - 0.99	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/12	0.46 - 14	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/11	0.24 - 1.4	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/11	0.33 - 0.87	N/A	8100	N	N	ND
108-88-3	Toluene	1.7 J	1.7 J	µg/kg	SS-84: 0-2 ft BGS (10/31/2018)	1/11	0.3 - 0.92	1.7 J	490000	N	N	BSV

Table 2.14

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Subsurface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/12	0.34 - 0.56	N/A	160000	N	N	ND
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/11	0.19 - 1.2	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/12	0.36 - 0.76	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/12	0.21 - 1.3	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/12	0.43 - 1.5	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	0.28 J	0.28 J	µg/kg	BH97-17: 13-15 ft BGS (12/8/2017)	1/12	0.25 - 1	0.28 J	59	C	N	BSV
1330-20-7	Xylenes (total)	1.5 J	1.5 J	µg/kg	SS-84: 0-2 ft BGS (10/31/2018)	1/11	0.35 - 1.9	1.5 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/12	10 - 22	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/12	26 - 150	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/12	9.4 - 140	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/12	21 - 95	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/12	21 - 87	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/12	22 - 310	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/12	18 - 130	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/12	22 - 120	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/12	0.47 - 30	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/12	8.6 - 22	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	4.5 J	770	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	12/12	--	770	240000	N	N	BSV
95-48-7	2-Methylphenol	84 J	84 J	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	1/12	12 - 67	84 J	320000	N	N	BSV
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/12	9.6 - 87	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/12	8.7 - 28	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	210 J	210 J	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	1/12	21 - 63	210 J	320000 (5)	N	N	BSV
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/12	19 - 93	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/12	17 - 110	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/12	9.7 - 170	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/12	14 - 30	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/12	22 - 98	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/12	18 - 65	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/12	14 - 30	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/12	27 - 130	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/12	18 - 200	N/A	--		N	ND
83-32-9	Acenaphthene	4.3 J	54	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	6/12	0.87 - 3.5	54	360000	N	N	BSV
208-96-8	Acenaphthylene	6.2 J	140	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	9/12	0.37 - 4.6	140	360000 (5)	N	N	BSV
98-86-2	Acetophenone	64 J	79 J	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/12	9.7 - 24	79 J	780000	N	N	BSV
120-12-7	Anthracene	5.0 J	270	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	12/12	--	270	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/12	9.6 - 78	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	69 J	110 J	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/12	13 - 50	110 J	170000	N	N	BSV
56-55-3	Benzo(a)anthracene	24	970	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	12/12	--	970	1100	C	N	BSV
50-32-8	**Benzo(a)pyrene**	**28**	**840**	**µg/kg**	**SS-83: 0-2 ft BGS (10/31/2018)**	**12/12**	**--**	**840**	**110**	**C**	**Y**	**ASV**

Table 2.14

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Subsurface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
205-99-2	**Benzo(b)fluoranthene**	**42**	**1300**	**µg/kg**	**SS-83: 0-2 ft BGS (10/31/2018)**	**12/12**	**--**	**1300**	**1100**	**C**	**Y**	**ASV**
191-24-2	Benzo(g,h,i)perylene	33	530	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	12/12	--	530	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	15	450	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	12/12	--	450	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	4.4 J	110	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	5/12	4 - 37	110	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/12	12 - 26	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/12	2.1 - 26	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	38 J	110	µg/kg	SS-32: 0.25-2.25 ft BGS (10/31/2018)	3/12	20 - 110	110	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/12	11 - 48	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/12	39 - 160	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**33 J**	**280**	**µg/kg**	**SS-83: 0-2 ft BGS (10/31/2018)**	**5/12**	**21 - 31**	**280**	**--**		**Y**	**AD**
218-01-9	Chrysene	30	870	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	12/12	--	870	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**11 J**	**150**	**µg/kg**	**SS-83: 0-2 ft BGS (10/31/2018)**	**11/12**	**0.76 - 0.77**	**150**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	17 J	270	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	9/12	0.69 - 14	270	7300	N	N	BSV
84-66-2	Diethyl phthalate	43 J	43 J	µg/kg	BH119-18: 9-11 ft BGS (1/18/2018)	1/12	17 - 67	43 J	5100000	N	N	BSV
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/12	14 - 30	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	20 J	20 J	µg/kg	BH97-17: 13-15 ft BGS (12/8/2017)	1/12	16 - 48	20 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/12	8.3 - 61	N/A	63000	N	N	ND
206-44-0	Fluoranthene	41	2100	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	12/12	--	2100	240000	N	N	BSV
86-73-7	Fluorene	4.0 J	120	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	8/12	0.61 - 3.4	120	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/12	2.2 - 6.2	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/12	5.9 - 26	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/12	8.5 - 130	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/12	9.3 - 20	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	26	490	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	12/12	--	490	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/12	12 - 26	N/A	570000	C	N	ND
91-20-3	Naphthalene	5.6 J	460	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	12/12	--	460	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/12	2.3 - 28	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/12	6.6 - 24	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/12	12 - 26	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/12	9.6 - 130	N/A	1000	C	N	ND
85-01-8	Phenanthrene	28	1300	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	12/12	--	1300	180000 (5)	N	N	BSV
108-95-2	Phenol	12 J	180	µg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/12	7.7 - 17	180	1900000	N	N	BSV
129-00-0	Pyrene	30	1500	µg/kg	SS-83: 0-2 ft BGS (10/31/2018)	12/12	--	1500	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**2000**	**12000**	**mg/kg**	**SS-79: 0-2 ft BGS (10/31/2018)**	**12/12**	**--**	**12000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.25 J	2.0 J	mg/kg	BH118-18: 3-5 ft BGS (1/18/2018)	10/12	0.1 - 0.34	2.0 J	3.1	N	N	BSV
7440-38-2	**Arsenic**	**4**	**27**	**mg/kg**	**SS-79: 0-2 ft BGS (10/31/2018)**	**12/12**	**--**	**27**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	20	690	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	12/12	--	690	1500	N	N	BSV
7440-41-7	Beryllium	0.25	2.8	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	12/12	--	2.8	16	N	N	BSV
7440-43-9	Cadmium	0.12 J	0.94	mg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	12/12	--	0.94	7.1	N	N	BSV
7440-70-2	Calcium	1400 J	140000	mg/kg	SS-32: 0.25-2.25 ft BGS (10/31/2018)	12/12	--	140000	--		N	NAT

Table 2.14

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Subsurface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
16065-83-1	Chromium III (trivalent)	6.2	80	mg/kg	SS-82: 0-2 ft BGS (10/31/2018)	12/12	--	80	12000	N	N	BSV
18540-29-9	**Chromium VI (hexavalent)**	**0.30 J**	**0.88 J**	**mg/kg**	**BH97-17: 13-15 ft BGS (12/8/2017)**	**4/12**	**0.25 - 1.4**	**0.88 J**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**2.6**	**8.9**	**mg/kg**	**SS-79: 0-2 ft BGS (10/31/2018)**	**12/12**	**--**	**8.9**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	8.1	92	mg/kg	BH118-18: 3-5 ft BGS (1/18/2018)	12/12	--	92	310	N	N	BSV
57-12-5	**Cyanide (total)**	**0.077 J**	**7.6**	**mg/kg**	**BH119-18: 9-11 ft BGS (1/18/2018)**	**6/12**	**0.2 - 0.27**	**7.6**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**7400**	**47000**	**mg/kg**	**BH118-18: 3-5 ft BGS (1/18/2018)**	**12/12**	**--**	**47000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	4.5	140	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	12/12	--	140	400	C	N	BSV
7439-92-1	Lead - coarse fraction	44 J	52 J	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/2	--	52 J	400	C	N	BSV
7439-92-1	Lead - fine fraction	74	99	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/2	--	99	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	48	64	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	2/2	--	64	400	C	N	BSV
7439-95-4	Magnesium	610 J	43000	mg/kg	SS-32: 0.25-2.25 ft BGS (10/31/2018)	12/12	--	43000	--		N	NAT
7439-96-5	**Manganese**	**210**	**890 J**	**mg/kg**	**BH118-18: 3-5 ft BGS (1/18/2018)**	**12/12**	**--**	**890 J**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.024 J	0.27	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	11/12	0.021	0.27	1.1	N	N	BSV
7440-02-0	Nickel	7.4	41	mg/kg	BH118-18: 3-5 ft BGS (1/18/2018)	12/12	--	41	150	N	N	BSV
7440-09-7	Potassium	140 J	1300	mg/kg	BH119-18: 9-11 ft BGS (1/18/2018)	12/12	--	1300	--		N	NAT
7782-49-2	Selenium	0.32 J	2.3	mg/kg	BH119-18: 9-11 ft BGS (1/18/2018)	12/12	--	2.3	39	N	N	BSV
7440-22-4	Silver	0.036 J	0.23	mg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	11/12	0.018	0.23	39	N	N	BSV
7440-23-5	Sodium	55 J	640	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	11/12	100 - 110	640	--		N	NAT
7440-28-0	**Thallium**	**0.089 J**	**0.38**	**mg/kg**	**SS-80: 0-2 ft BGS (10/31/2018)**	**12/12**	**--**	**0.38**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	4.6	36	mg/kg	SS-79: 0-2 ft BGS (10/31/2018)	12/12	--	36	39	N	N	BSV
7440-66-6	Zinc	31	270	mg/kg	BH119-18: 9-11 ft BGS (1/18/2018)	12/12	--	270	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/12	22 - 27	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/12	24 - 29	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/12	23 - 28	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/12	19 - 23	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/12	24 - 29	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**40 J**	**760 J**	**µg/kg**	**SS-84: 0-2 ft BGS (10/31/2018)**	**4/12**	**23 - 28**	**760 J**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/12	22 - 27	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	4.3 J	4.3 J	µg/kg	SS-78: 0-2 ft BGS (10/31/2018)	1/12	1.5 - 37	4.3 J	190	C	N	BSV
72-55-9	4,4'-DDE	5.2 J	30	µg/kg	SS-84: 0-2 ft BGS (10/31/2018)	2/12	1.2 - 18	30	2000	C	N	BSV
50-29-3	4,4'-DDT	2.9 J	13 J	µg/kg	SS-84: 0-2 ft BGS (10/31/2018)	3/12	1.2 - 16	13 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/12	0.78 - 27	N/A	39	C	N	ND
319-84-6	alpha-BHC	1.9 J	13 J	µg/kg	SS-80: 0-2 ft BGS (10/31/2018)	2/12	0.93 - 18	13 J	86	C	N	BSV
5103-71-9	alpha-Chlordane	1.7 J	1.7 J	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	1/12	1.5 - 43	1.7 J	1700	C	N	BSV
319-85-7	beta-BHC	2.2 J	7.3 J	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	3/12	1.8 - 44	7.3 J	300	C	N	BSV
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/12	1.4 - 72	N/A	300	C	N	ND
60-57-1	**Dieldrin**	**3.3 J**	**37 J**	**µg/kg**	**SS-81: 0.33-2.33 ft BGS (10/31/2018)**	**2/12**	**0.94 - 13**	**37 J**	**34**	**C**	**Y**	**ASV**
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/12	1.2 - 15	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/12	1.5 - 20	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/12	1.2 - 66	N/A	38000	N	N	ND

Table 2.14

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Subsurface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/12	1.5 - 23	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	2.4 J	2.4 J	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	1/12	1.3 - 99	2.4 J	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/12	0.91 - 12	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/12	1.8 - 33	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	1.8 J	1.8 J	µg/kg	SS-78: 0-2 ft BGS (10/31/2018)	2/12	1.3 - 17	1.8 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/12	0.81 - 19	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	4.2 J	4.2 J	µg/kg	SS-81: 0.33-2.33 ft BGS (10/31/2018)	1/12	1.5 - 27	4.2 J	70	C	N	BSV
72-43-5	Methoxychlor	1.5 NJ	1.5 NJ	µg/kg	BH117-18: 10-12 ft BGS (1/18/2018)	1/12	1.2 - 80	1.5 NJ	32000	N	N	BSV
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/12	25 - 420	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	14	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/1	15	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/1	54	N/A	70000	N	N	ND
	Dioxins/Furans											
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	11 J	11 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	11 J	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	150	160	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	160	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	11	13	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	13	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	14	14	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	14	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.45 J	0.51 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	0.51 J	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	0.82 J	0.87 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	0.87 J	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.22 J	0.23 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	0.23 J	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.2 J	1.2 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	1.2 J	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.91 J	0.95 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	0.95 J	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/1	0.15 - 0.24	N/A	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.60 J	0.68 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	0.68 J	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ND	ND	pg/g	--	0/1	0.17 - 0.21	N/A	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.32 J	0.32 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	0.14	0.32 J	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.44 J	0.45 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	0.45 J	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.41 J	0.41 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	0.19	0.41 J	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.82 J	1.2	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	1.2	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.18 J	0.18 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	0.068	0.18 J	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	28 J	30 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	30 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	27 J	28 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	28 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	25 J	30 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	30 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	6.9 J	7.0 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	7.0 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	40 J	54 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	54 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	18 J	20 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	20 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	49 J	64 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	64 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	1.9 J	1.9 J	pg/g	BH97-17: 13-15 ft BGS (12/8/2017)	1/1	--	1.9 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**0.8278**	**1.4834**	**pg/g**	**BH97-17: 13-15 ft BGS (12/8/2017)**	**1/1**	**--**	**1.4834**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**0.97545**	**1.49345**	**pg/g**	**BH97-17: 13-15 ft BGS (12/8/2017)**	**1/1**	**--**	**1.49345**	**4.8**	**C**	**Y**	**(6)**

Table 2.14

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Subsurface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos										
1332-21-4	Asbestos	ND	ND	%	--	0/5	0.25 - 1	N/A	--	N	ND
12001-29-5	Chrysotile asbestos	ND	ND	%	--	0/1	0.25	N/A	--	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-32, SS-78, SS-79, SS-80, SS-81, SS-82, SS-83, SS-84, SS-85, SS-163-AS, SS-164-AS, BH117-18, BH-118-18, BH119-18, BH97-17.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.15

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	0.54 J	0.54 J	µg/kg	SS-25: 0-2 ft BGS (11/1/2017)	1/8	0.73 - 1	0.54 J	810000	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/7	0.3 - 1.8	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/8	0.45 - 1.4	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/8	0.38 - 0.87	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/8	0.62 - 1.1	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/7	0.27 - 0.72	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/7	0.78 - 4.5	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/8	0.4 - 0.97	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/7	0.25 - 1.4	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/8	0.33 - 0.97	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/8	0.35 - 1.1	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/7	0.33 - 1	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/7	0.4 - 1.1	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	4.2 J	12 J	µg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	4/8	1.5 - 4.2	12 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/8	0.66 - 5.1	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/8	1 - 4.7	N/A	3300000	N	N	ND
67-64-1	Acetone	25 J	60	µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	4/8	3.5 - 25	60	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/8	0.37 - 0.88	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/8	0.38 - 0.85	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/8	0.46 - 3	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/8	0.67 - 1.2	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/8	0.24 - 1.5	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/8	0.29 - 4.1	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/8	0.38 - 1.2	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/8	0.43 - 1.5	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/8	0.26 - 0.99	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/8	0.43 - 1.3	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.39 J	1.6 J	µg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	2/8	0.58 - 1.2	1.6 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/8	0.3 - 1.8	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/8	0.24 - 1.7	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/8	0.34 - 3.5	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/8	0.4 - 1.2	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/8	0.31 - 1.3	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/8	0.23 - 1	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/8	1.3 - 4.3	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/8	0.26 - 1.5	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/8	0.31 - 1	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/8	0.27 - 15	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/8	0.31 - 1.5	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	1.1 J	1.1 J	µg/kg	SS-25: 0-2 ft BGS (11/1/2017)	1/8	0.65 - 0.92	1.1 J	8100	N	N	BSV
108-88-3	Toluene	ND	ND	µg/kg	--	0/8	0.39 - 0.97	N/A	490000	N	N	ND
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/8	0.42 - 0.59	N/A	160000	N	N	ND

Table 2.15

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/8	0.24 - 1.3	N/A	1800	C	N	ND
79-01-6	Trichloroethene	1.1 J	67	µg/kg	SS-25: 0-2 ft BGS (11/1/2017)	4/8	0.57 - 0.69	67	410	N	N	BSV
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/8	0.27 - 1.4	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/8	0.56 - 1.6	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/8	0.32 - 1.1	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/8	0.46 - 2	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/8	10 - 21	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/8	27 - 150	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/8	9.6 - 140	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/8	22 - 93	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/8	22 - 85	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/8	23 - 300	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/8	18 - 130	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/8	23 - 120	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/8	0.49 - 30	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/8	8.8 - 21	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	15 J	610	µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	610	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/8	12 - 66	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/8	9.8 - 85	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/8	9 - 28	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/8	22 - 61	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/8	19 - 91	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/8	17 - 100	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/8	9.9 - 170	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/8	14 - 30	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/8	23 - 95	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/8	18 - 64	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/8	14 - 30	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/8	28 - 130	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/8	18 - 200	N/A	--		N	ND
83-32-9	Acenaphthene	5.0 J	48	µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	6/8	3.1 - 3.3	48	360000	N	N	BSV
208-96-8	Acenaphthylene	5.1 J	120	µg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	7/8	4.7	120	360000 (5)	N	N	BSV
98-86-2	Acetophenone	26 J	53 J	µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	2/8	12 - 23	53 J	780000	N	N	BSV
120-12-7	Anthracene	14 J	200	µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	7/8	2.8	200	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/8	9.8 - 76	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	25 J	55 J	µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	2/8	25 - 49	55 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**11 J**	**1200**	**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**1200**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**33**	**1400**	**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**7/8**	**11**	**1400**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**14 J**	**2000**	**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**2000**	**1100**	**C**	**Y**	**ASV**

Table 2.15

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	8.5 J	940	µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	8/8	--	940	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	28	640	µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	7/8	8.1	640	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	7.4 J	56 J	µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	2/8	18 - 36	56 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/8	13 - 25	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/8	2.2 - 25	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	69 J	630	µg/kg	SS-25: 0-2 ft BGS (11/1/2017)	2/8	55 - 110	630	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	41 J	41 J	µg/kg	SS-70: 0-2 ft BGS (10/30/2018)	1/8	11 - 47	41 J	290000	C	N	BSV
105-60-2	Caprolactam	44 J	44 J	µg/kg	SS-25: 0-2 ft BGS (11/1/2017)	1/8	80 - 160	44 J	3100000	N	N	BSV
86-74-8	**Carbazole**	**25 J**	**120**	**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**6/8**	**22 - 29**	**120**	**--**		**Y**	**AD**
218-01-9	Chrysene	17	1300	µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	8/8	--	1300	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**19**	**220**	**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**6/8**	**0.71 - 8**	**220**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	13 J	150	µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	7/8	14	150	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/8	17 - 66	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/8	15 - 30	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	27 J	27 J	µg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	1/8	16 - 47	27 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/8	8.5 - 59	N/A	63000	N	N	ND
206-44-0	Fluoranthene	16 J	2000	µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	8/8	--	2000	240000	N	N	BSV
86-73-7	Fluorene	3.8 J	85	µg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	7/8	3.2	85	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/8	2.3 - 6	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/8	6 - 25	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/8	8.7 - 130	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/8	9.6 - 19	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	23	910	µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	7/8	8.6	910	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/8	13 - 25	N/A	570000	C	N	ND
91-20-3	Naphthalene	11 J	400	µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	400	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/8	2.4 - 28	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/8	6.8 - 23	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/8	13 - 25	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/8	9.8 - 120	N/A	1000	C	N	ND
85-01-8	Phenanthrene	34	900	µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	8/8	--	900	180000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/8	7.9 - 17	N/A	1900000	N	N	ND
129-00-0	Pyrene	19	1800	µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	8/8	--	1800	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**3300**	**11000**	**mg/kg**	**SS-75: 0.5-2.5 ft BGS (10/30/2018)**	**8/8**	**--**	**11000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.19 J	2.4 J	mg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	8/8	--	2.4 J	3.1	N	N	BSV
7440-38-2	**Arsenic**	**3.9**	**13**	**mg/kg**	**SS-71: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**13**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	35 J	240	mg/kg	SS-76: 0-2 ft BGS (10/30/2018)	8/8	--	240	1500	N	N	BSV
7440-41-7	Beryllium	0.22	1.1	mg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	8/8	--	1.1	16	N	N	BSV
7440-43-9	Cadmium	0.21	1	mg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	1	7.1	N	N	BSV
7440-70-2	Calcium	28000	150000	mg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	150000	--		N	NAT
16065-83-1	Chromium III (trivalent)	7.2	24	mg/kg	SS-74: 0-2 ft BGS (10/30/2018)	8/8	--	24	12000	N	N	BSV

Table 2.15

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.60 J**	**3.6**	**mg/kg**	**SS-25: 0-2 ft BGS (11/1/2017)**	**2/8**	**0.26 - 1.4**	**3.6**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**3.5**	**6.9**	**mg/kg**	**SS-75: 0.5-2.5 ft BGS (10/30/2018)**	**8/8**	**--**	**6.9**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	11	120	mg/kg	SS-25: 0-2 ft BGS (11/1/2017)	8/8	--	120	310	N	N	BSV
57-12-5	Cyanide (total)	0.21 J	0.27 J	mg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	3/8	0.18 - 0.46	0.27 J	2.3	N	N	BSV
7439-89-6	**Iron**	**8200**	**25000**	**mg/kg**	**SS-75: 0.5-2.5 ft BGS (10/30/2018)**	**8/8**	**--**	**25000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	17 J	160	mg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	8/8	--	160	400	C	N	BSV
7439-92-1	Lead - coarse fraction	31	82	mg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	2/2	--	82	400	C	N	BSV
7439-92-1	Lead - fine fraction	85	150	mg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	2/2	--	150	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	35	89	mg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	2/2	--	89	400	C	N	BSV
7439-95-4	Magnesium	12000	83000	mg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	83000	--		N	NAT
7439-96-5	**Manganese**	**280**	**550**	**mg/kg**	**SS-76: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**550**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.023 J	0.85	mg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	8/8	--	0.85	1.1	N	N	BSV
7440-02-0	Nickel	7.6	20	mg/kg	SS-74: 0-2 ft BGS (10/30/2018)	8/8	--	20	150	N	N	BSV
7440-09-7	Potassium	410	1300	mg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	8/8	--	1300	--		N	NAT
7782-49-2	Selenium	0.17 J	0.50 J	mg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	7/8	0.93	0.50 J	39	N	N	BSV
7440-22-4	Silver	0.039 J	0.16 J	mg/kg	SS-25: 0-2 ft BGS (11/1/2017)	8/8	--	0.16 J	39	N	N	BSV
7440-23-5	Sodium	78 J	590	mg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	7/8	100	590	--		N	NAT
7440-28-0	**Thallium**	**0.12 J**	**0.24**	**mg/kg**	**SS-75: 0.5-2.5 ft BGS (10/30/2018)**	**7/8**	**0.095**	**0.24**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	8.6	33	mg/kg	SS-70: 0-2 ft BGS (10/30/2018)	8/8	--	33	39	N	N	BSV
7440-66-6	Zinc	38 J	100 J	mg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	8/8	--	100 J	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/8	23 - 26	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/8	25 - 27	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/8	17 - 26	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/8	20 - 22	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/8	18 - 27	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**96**	**910**	**µg/kg**	**SS-75: 0.5-2.5 ft BGS (10/30/2018)**	**4/8**	**24 - 26**	**910**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	23 J	36 J	µg/kg	SS-71: 0-2 ft BGS (10/30/2018)	2/8	19 - 25	36 J	240	C	N	BSV
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/8	15 - 71	N/A	190	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/8	16 - 26	N/A	2000	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/kg	--	0/8	12 - 30	N/A	1900	C	N	ND
309-00-2	Aldrin	ND	ND	µg/kg	--	0/8	8 - 52	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/8	9.4 - 35	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/8	16 - 82	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/8	18 - 84	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/8	17 - 91	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/8	11 - 19	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/8	12 - 28	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/8	15 - 39	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/8	13 - 26	N/A	38000	N	N	ND

Table 2.15

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/8	20 - 30	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/8	14 - 39	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/8	9.2 - 24	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/8	19 - 63	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/8	13 - 32	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/8	16 - 18	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/8	15 - 52	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/8	26 - 74	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/8	260 - 800	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	16	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/1	17	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/1	61	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/2	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-25, SS-70, SS-71, SS-72, SS-73, SS-74, SS-75, SS-76, SS-77, SS-165-AS, SS-166-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.16

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Minimum Qualifier	Maximum Concentration (1, 2)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds												
71-55-6	1,1,1-Trichloroethane	0.54 J		0.54 J		µg/kg	SS-25: 0-2 ft BGS (11/1/2017)	1/16	0.2 - 77	0.54 J	810000 N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND		ND		µg/kg	--	0/15	0.22 - 66	N/A	600 C	N	ND
79-00-5	1,1,2-Trichloroethane	ND		ND		µg/kg	--	0/16	0.34 - 63	N/A	150 N	N	ND
75-34-3	1,1-Dichloroethane	ND		ND		µg/kg	--	0/16	0.29 - 85	N/A	3.6 C	N	ND
75-35-4	1,1-Dichloroethene	ND		ND		µg/kg	--	0/16	0.47 - 99	N/A	23000 N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND		ND		µg/kg	--	0/15	0.21 - 71	N/A	5800 N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND		ND		µg/kg	--	0/15	0.59 - 130	N/A	5.3 C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND		ND		µg/kg	--	0/16	0.3 - 63	N/A	36 C	N	ND
95-50-1	1,2-Dichlorobenzene	ND		ND		µg/kg	--	0/15	0.19 - 49	N/A	180000 N	N	ND
107-06-2	1,2-Dichloroethane	ND		ND		µg/kg	--	0/16	0.25 - 82	N/A	460 C	N	ND
78-87-5	1,2-Dichloropropane	ND		ND		µg/kg	--	0/16	0.27 - 82	N/A	1600 N	N	ND
541-73-1	1,3-Dichlorobenzene	ND		ND		µg/kg	--	0/15	0.25 - 100	N/A	180000 (5) N	N	ND
106-46-7	1,4-Dichlorobenzene	ND		ND		µg/kg	--	0/15	0.3 - 74	N/A	2600 C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	4.2 J		12 J		µg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	4/16	1.1 - 140	12 J	2700000 N	N	BSV
591-78-6	2-Hexanone	ND		ND		µg/kg	--	0/16	0.5 - 240	N/A	20000 N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND		ND		µg/kg	--	0/16	0.77 - 110	N/A	3300000 N	N	ND
67-64-1	Acetone	25 J		60		µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	4/14	2.6 - 270	60	6100000 N	N	BSV
71-43-2	Benzene	ND		ND		µg/kg	--	0/16	0.28 - 66	N/A	1200 C	N	ND
75-27-4	Bromodichloromethane	ND		ND		µg/kg	--	0/16	0.29 - 49	N/A	290 C	N	ND
75-25-2	Bromoform	ND		ND		µg/kg	--	0/16	0.35 - 63	N/A	19000 C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND		ND		µg/kg	--	0/16	0.51 - 77	N/A	680 N	N	ND
75-15-0	Carbon disulfide	ND		ND		µg/kg	--	0/16	0.18 - 49	N/A	77000 N	N	ND
56-23-5	Carbon tetrachloride	ND		ND		µg/kg	--	0/16	0.22 - 74	N/A	650 C	N	ND
108-90-7	Chlorobenzene	ND		ND		µg/kg	--	0/16	0.29 - 82	N/A	28000 N	N	ND
75-00-3	Chloroethane	ND		ND		µg/kg	--	0/16	0.33 - 77	N/A	1400000 N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND		ND		µg/kg	--	0/16	0.2 - 66	N/A	320 C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND		ND		µg/kg	--	0/16	0.33 - 49	N/A	11000 N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.39 J		1.6 J		µg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	2/16	0.24 - 96	1.6 J	16000 N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND		ND		µg/kg	--	0/16	0.22 - 63	N/A	1800 C	N	ND
110-82-7	Cyclohexane	ND		ND		µg/kg	--	0/16	0.18 - 82	N/A	650000 N	N	ND
124-48-1	Dibromochloromethane	ND		ND		µg/kg	--	0/16	0.26 - 93	N/A	8300 C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND		ND		µg/kg	--	0/16	0.3 - 60	N/A	8700 N	N	ND
100-41-4	Ethylbenzene	0.30 J		8.6 J		µg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	2/16	0.23 - 96	8.6 J	5800 C	N	BSV
98-82-8	Isopropyl benzene	1.4 J		1.4 J		µg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	1/16	0.17 - 93	1.4 J	190000 N	N	BSV
79-20-9	Methyl acetate	ND		ND		µg/kg	--	0/16	1 - 210	N/A	7800000 N	N	ND
108-87-2	Methyl cyclohexane	0.25 J		0.25 J		µg/kg	BH114-18: 3-5 ft BGS (1/11/2018)	1/16	0.2 - 100	0.25 J	650000 (5) N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND		ND		µg/kg	--	0/16	0.23 - 71	N/A	47000 C	N	ND
75-09-2	Methylene chloride	ND		ND		µg/kg	--	0/16	0.27 - 180	N/A	35000 N	N	ND
100-42-5	Styrene	ND		ND		µg/kg	--	0/16	0.23 - 27	N/A	600000 N	N	ND
127-18-4	Tetrachloroethene	1.1 J		1.1 J		µg/kg	SS-25: 0-2 ft BGS (11/1/2017)	1/16	0.32 - 58	1.1 J	8100 N	N	BSV
108-88-3	Toluene	0.32 J		75 J		µg/kg	TP-13: 8-10 ft BGS (11/1/2017)	3/16	0.32 - 5.3	75 J	490000 N	N	BSV

Table 2.16

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Minimum Qualifier	Maximum Concentration (1, 2)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)													
156-60-5	trans-1,2-Dichloroethene	ND		ND		µg/kg	--	0/16	0.33 - 96	N/A	160000	N	N	ND
10061-02-6	trans-1,3-Dichloropropene	ND		ND		µg/kg	--	0/16	0.18 - 41	N/A	1800	C	N	ND
79-01-6	**Trichloroethene**	**0.45 J**		**2400**		**µg/kg**	**TP-13: 8-10 ft BGS (11/1/2017)**	**7/16**	**0.35 - 5.3**	**2400**	**410**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND		ND		µg/kg	--	0/16	0.21 - 93	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND		ND		µg/kg	--	0/16	0.42 - 63	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND		ND		µg/kg	--	0/16	0.24 - 47	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	1.0 J		6.4 J		µg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	3/16	0.35 - 77	6.4 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds													
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND		ND		µg/kg	--	0/16	10 - 220	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND		ND		µg/kg	--	0/16	27 - 330	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND		ND		µg/kg	--	0/16	9.6 - 330	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND		ND		µg/kg	--	0/16	22 - 330	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND		ND		µg/kg	--	0/16	22 - 330	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND		ND		µg/kg	--	0/16	23 - 720	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND		ND		µg/kg	--	0/16	18 - 430	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND		ND		µg/kg	--	0/16	23 - 430	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND		ND		µg/kg	--	0/16	0.48 - 110	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND		ND		µg/kg	--	0/16	8.8 - 110	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	8.4		610		µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	13/16	7.2 - 7.4	610	240000	N	N	BSV
95-48-7	2-Methylphenol	ND		ND		µg/kg	--	0/16	12 - 430	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND		ND		µg/kg	--	0/16	9.8 - 430	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND		ND		µg/kg	--	0/16	8.9 - 110	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND		ND		µg/kg	--	0/12	22 - 61	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND		ND		µg/kg	--	0/15	19 - 220	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND		ND		µg/kg	--	0/16	17 - 430	N/A	--		N	ND
106-44-5	4-Methylphenol	ND		ND		µg/kg	--	0/4	220 - 430	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND		ND		µg/kg	--	0/16	9.9 - 330	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND		ND		µg/kg	--	0/16	14 - 110	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND		ND		µg/kg	--	0/16	23 - 330	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND		ND		µg/kg	--	0/16	18 - 330	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND		ND		µg/kg	--	0/16	14 - 110	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND		ND		µg/kg	--	0/16	28 - 430	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND		ND		µg/kg	--	0/16	18 - 720	N/A	--		N	ND
83-32-9	Acenaphthene	5.0 J		56		µg/kg	TT-11: 10 ft BGS (10/2/2008)	10/16	0.82 - 7.4	56	360000	N	N	BSV
208-96-8	Acenaphthylene	4.0 J		120		µg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	12/16	0.38 - 7.4	120	360000 (5)	N	N	BSV
98-86-2	Acetophenone	26 J		53 J		µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	3/16	9.9 - 220	53 J	780000	N	N	BSV
120-12-7	Anthracene	4.3 J		200		µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	13/16	2.8 - 7.4	200	1800000	N	N	BSV
1912-24-9	Atrazine	ND		ND		µg/kg	--	0/16	9.8 - 430	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	25 J		55 J		µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	3/16	13 - 220	55 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**11 J**		**1200**		**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**16/16**	**--**	**1200**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**13**		**1400**		**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**15/16**	**11**	**1400**	**110**	**C**	**Y**	**ASV**

Table 2.16

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Minimum Qualifier	Maximum Concentration (1, 2)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)													
205-99-2	**Benzo(b)fluoranthene**	**14 J**		**2000**		**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**16/16**	**--**	**2000**	**1100**	**C**	**Y**	**ASV**
191-24-2	Benzo(g,h,i)perylene	8.5 J		940		µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	16/16	--	940	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	7.6		640		µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	15/16	8.1	640	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	7.4 J		56 J		µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	4/16	3.8 - 110	56 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND		ND		µg/kg	--	0/16	13 - 220	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND		ND		µg/kg	--	0/16	2.2 - 220	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	23 J		630		µg/kg	SS-25: 0-2 ft BGS (11/1/2017)	3/16	28 - 110	630	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	41 J		41 J		µg/kg	SS-70: 0-2 ft BGS (10/30/2018)	1/16	11 - 110	41 J	290000	C	N	BSV
105-60-2	Caprolactam	44 J		44 J		µg/kg	SS-25: 0-2 ft BGS (11/1/2017)	1/16	40 - 720	44 J	3100000	N	N	BSV
86-74-8	**Carbazole**	**25 J**		**120**		**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**7/16**	**22 - 68**	**120**	**--**		**Y**	**AD**
218-01-9	Chrysene	13		1300		µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	16/16	--	1300	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**10**		**220**		**µg/kg**	**SS-74: 0-2 ft BGS (10/30/2018)**	**10/16**	**0.71 - 8**	**220**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	11 J		150		µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	10/16	0.71 - 110	150	7300	N	N	BSV
84-66-2	Diethyl phthalate	21 J		21 J		µg/kg	BH114-18: 3-5 ft BGS (1/11/2018)	1/16	17 - 110	21 J	5100000	N	N	BSV
131-11-3	Dimethyl phthalate	ND		ND		µg/kg	--	0/16	15 - 110	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	27 J		27 J		µg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	1/16	16 - 110	27 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND		ND		µg/kg	--	0/16	8.5 - 110	N/A	63000	N	N	ND
206-44-0	Fluoranthene	16 J		2000		µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	16/16	--	2000	240000	N	N	BSV
86-73-7	Fluorene	3.8 J		85		µg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	11/16	0.57 - 7.4	85	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND		ND		µg/kg	--	0/16	2.3 - 14	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND		ND		µg/kg	--	0/16	6 - 110	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND		ND		µg/kg	--	0/15	8.7 - 720	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND		ND		µg/kg	--	0/16	9.6 - 110	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	8.8		910		µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	15/16	8.6	910	1100	C	N	BSV
78-59-1	Isophorone	ND		ND		µg/kg	--	0/16	13 - 110	N/A	570000	C	N	ND
91-20-3	Naphthalene	5.7 J		400		µg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	13/16	7.2 - 7.4	400	3800	C	N	BSV
98-95-3	Nitrobenzene	ND		ND		µg/kg	--	0/16	2.4 - 220	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND		ND		µg/kg	--	0/16	6.8 - 110	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND		ND		µg/kg	--	0/16	13 - 110	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND		ND		µg/kg	--	0/15	9.8 - 330	N/A	1000	C	N	ND
85-01-8	Phenanthrene	11		900		µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	16/16	--	900	180000 (5)	N	N	BSV
108-95-2	Phenol	ND		ND		µg/kg	--	0/16	7.9 - 110	N/A	1900000	N	N	ND
129-00-0	Pyrene	19		1800		µg/kg	SS-74: 0-2 ft BGS (10/30/2018)	16/16	--	1800	180000	N	N	BSV
	Metals													
7429-90-5	**Aluminum**	**1980**		**14000 J**		**mg/kg**	**BH115-18: 3-5 ft BGS (1/11/2018)**	**16/16**	**--**	**14000 J**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.19 J		2.8 J		mg/kg	BH116-18: 11-13 ft BGS (1/11/2018)	13/16	6.5 - 6.7	2.8 J	3.1	N	N	BSV
7440-38-2	**Arsenic**	**3.9**		**45**		**mg/kg**	**BH115-18: 3-5 ft BGS (1/11/2018)**	**16/16**	**--**	**45**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	35 J		440 J		mg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	16/16	--	440 J	1500	N	N	BSV
7440-41-7	Beryllium	0.12 J		6.5		mg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	16/16	--	6.5	16	N	N	BSV
7440-43-9	**Cadmium**	**0.099 J**		**19**		**mg/kg**	**BH116-18: 11-13 ft BGS (1/11/2018)**	**15/16**	**0.54**	**19**	**7.1**	**N**	**Y**	**ASV**

Table 2.16

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Minimum Qualifier	Maximum Concentration (1, 2)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)													
7440-70-2	Calcium	3400		150000		mg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	16/16	--	150000	--		N	NAT
16065-83-1	Chromium III (trivalent)	3.3		32		mg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	17/17	--	32	12000	N	N	BSV
18540-29-9	**Chromium VI (hexavalent)**	**0.32 J**		**3.7**		**mg/kg**	**TP-13: 8-10 ft BGS (11/1/2017)**	**9/17**	**0.26 - 1.6**	**3.7**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**2.3 J**		**22**		**mg/kg**	**BH115-18: 3-5 ft BGS (1/11/2018)**	**16/16**	**--**	**22**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**9.4**		**410**		**mg/kg**	**BH116-18: 11-13 ft BGS (1/11/2018)**	**16/16**	**--**	**410**	**310**	**N**	**Y**	**ASV**
57-12-5	Cyanide (total)	0.21 J		0.51 J		mg/kg	TT-12: 10 ft BGS (10/2/2008)	4/16	0.13 - 0.59	0.51 J	2.3	N	N	BSV
7439-89-6	**Iron**	**6020**		**63700**		**mg/kg**	**TT-11: 10 ft BGS (10/2/2008)**	**16/16**	**--**	**63700**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	15.8 J		160		mg/kg	SS-72: 0.5-2.25 ft BGS (10/30/2018)	16/16	--	160	400	C	N	BSV
7439-95-4	Magnesium	820		83000		mg/kg	SS-73: 0.17-2.17 ft BGS (10/30/2018)	16/16	--	83000	--		N	NAT
7439-96-5	**Manganese**	**46**		**734 J**		**mg/kg**	**TT-11: 10 ft BGS (10/2/2008)**	**16/16**	**--**	**734 J**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.023 J		0.85		mg/kg	SS-75: 0.5-2.5 ft BGS (10/30/2018)	16/16	--	0.85	1.1	N	N	BSV
7440-02-0	Nickel	6		36		mg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	16/16	--	36	150	N	N	BSV
7440-09-7	Potassium	310		1600		mg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	16/16	--	1600	--		N	NAT
7782-49-2	Selenium	0.17 J		7.3		mg/kg	BH116-18: 11-13 ft BGS (1/11/2018)	11/16	0.93 - 27.7	7.3	39	N	N	BSV
7440-22-4	Silver	0.029 J		0.44		mg/kg	BH116-18: 11-13 ft BGS (1/11/2018)	12/16	1.1	0.44	39	N	N	BSV
7440-23-5	Sodium	78 J		883		mg/kg	TT-12: 5 ft BGS (10/2/2008)	13/16	100 - 543	883	--		N	NAT
7440-28-0	**Thallium**	**0.12 J**		**1.4**		**mg/kg**	**BH115-18: 3-5 ft BGS (1/11/2018)**	**11/16**	**0.095 - 0.17**	**1.4**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**6.4 J**		**72**		**mg/kg**	**BH115-18: 3-5 ft BGS (1/11/2018)**	**16/16**	**--**	**72**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	26.4 J		1200		mg/kg	BH116-18: 11-13 ft BGS (1/11/2018)	16/16	--	1200	2300	N	N	BSV
	Polychlorinated Biphenyls													
12674-11-2	Aroclor-1016 (PCB-1016)	ND		ND		µg/kg	--	0/16	23 - 37	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND		ND		µg/kg	--	0/16	25 - 37	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND		ND		µg/kg	--	0/16	17 - 37	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND		ND		µg/kg	--	0/16	20 - 37	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND		ND		µg/kg	--	0/16	18 - 37	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**20 J**		**910**		**µg/kg**	**SS-75: 0.5-2.5 ft BGS (10/30/2018)**	**6/16**	**24 - 37**	**910**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	23 J		36 J		µg/kg	SS-71: 0-2 ft BGS (10/30/2018)	2/16	19 - 37	36 J	240	C	N	BSV
	Pesticides													
72-54-8	4,4'-DDD	ND		ND		µg/kg	--	0/16	3.6 - 92	N/A	190	C	N	ND
72-55-9	4,4'-DDE	24 J		43 J		µg/kg	TT-11: 10 ft BGS (10/2/2008)	2/16	1.3 - 26	43 J	2000	C	N	BSV
50-29-3	4,4'-DDT	3.1 J		3.1 J		µg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	1/16	1.5 - 92	3.1 J	1900	C	N	BSV
309-00-2	Aldrin	ND		ND		µg/kg	--	0/16	2.6 - 92	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND		ND		µg/kg	--	0/16	1.7 - 92	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND		ND		µg/kg	--	0/16	4.1 - 92	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND		ND		µg/kg	--	0/16	4.2 - 92	N/A	300	C	N	ND
319-86-8	delta-BHC	ND		ND		µg/kg	--	0/16	1.4 - 92	N/A	300	C	N	ND
60-57-1	Dieldrin	ND		ND		µg/kg	--	0/16	0.97 - 92	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND		ND		µg/kg	--	0/16	1.4 - 92	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND		ND		µg/kg	--	0/16	1.9 - 92	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND		ND		µg/kg	--	0/16	1.3 - 92	N/A	38000	N	N	ND

Table 2.16

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Minimum Qualifier	Maximum Concentration (1, 2)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)													
72-20-8	Endrin	ND		ND		µg/kg	--	0/16	1.5 - 92	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	5.4 J		5.4 J		µg/kg	BH115-18: 3-5 ft BGS (1/11/2018)	1/16	1.9 - 92	5.4 J	1900	N	N	BSV
53494-70-5	Endrin ketone	ND		ND		µg/kg	--	0/16	1.2 - 92	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND		ND		µg/kg	--	0/16	3.1 - 92	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	29 J		29 J		µg/kg	TT-11: 5 ft BGS (10/2/2008)	1/16	1.6 - 92	29 J	1700	C	N	BSV
76-44-8	Heptachlor	ND		ND		µg/kg	--	0/16	0.84 - 92	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND		ND		µg/kg	--	0/16	2.6 - 92	N/A	70	C	N	ND
72-43-5	Methoxychlor	2.7 J		2.7 J		µg/kg	BH114-18: 3-5 ft BGS (1/11/2018)	1/16	1.3 - 180	2.7 J	32000	N	N	BSV
8001-35-2	Toxaphene	ND		ND		µg/kg	--	0/16	40 - 3600	N/A	490	C	N	ND
	Herbicides													
93-72-1	2,4,5-TP (Silvex)	ND		ND		µg/kg	--	0/5	17 - 22	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND		ND		µg/kg	--	0/5	61 - 89	N/A	70000	N	N	ND
	Dioxins/Furans													
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	ND		ND		pg/g	--	0/1	9.4	N/A	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	150		150		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	150	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	7.1		7.1		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	7.1	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	27		27		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	27	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ND		ND		pg/g	--	0/1	0.23	N/A	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	1.2 J		1.2 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	1.2 J	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.51 J		0.51 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	0.51 J	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.85 J		0.85 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	0.85 J	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	4.5 J		4.5 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	4.5 J	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ND		ND		pg/g	--	0/1	0.15	N/A	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	2.3 J		2.3 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	2.3 J	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.27 J		0.27 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	0.27 J	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.66 J		0.66 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	0.66 J	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.63 J		0.63 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	0.63 J	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.39 J		0.39 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	0.39 J	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1.1		1.1		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	1.1	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.17 J		0.17 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	0.17 J	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	18 J		18 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	18 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	51 J		51 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	51 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	14 J		14 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	14 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	32 J		32 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	32 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	12 J		12 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	12 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	31 J		31 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	31 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	19 J		19 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	19 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	2.6 J		2.6 J		pg/g	TP-13: 8-10 ft BGS (11/1/2017)	1/1	--	2.6 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**2.4501**		**2.4501**		**pg/g**	**TP-13: 8-10 ft BGS (11/1/2017)**	**1/1**	**--**	**2.4501**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**2.458783**		**2.458783**		**pg/g**	**TP-13: 8-10 ft BGS (11/1/2017)**	**1/1**	**--**	**2.458783**	**4.8**	**C**	**Y**	**(6)**

Table 2.16

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU11 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Minimum Qualifier	Maximum Concentration (1, 2)	Maximum Qualifier	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos												
1332-21-4	Asbestos	ND		ND		%	--	0/4	0.25 - 1	N/A	--	N	ND
12001-29-5	**Chrysotile asbestos**	**2**		**2**		**%**	**BH116-18: 11-13 ft BGS (1/11/2018)**	**1/1**	**--**	**2**	**--**	**Y**	**AD**

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-25, SS-70, SS-71, SS-72, SS-73, SS-74, SS-75, SS-76, SS-77, SS-165-AS, SS-166-AS, BH114-18, BH115-18, BH116-18, BH175-17, TP-13, TT-11, TT-12.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.17

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/8	0.68 - 33	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/7	1.2 - 33	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/8	0.93 - 30	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	1.3 J	1.3 J	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	1/8	0.57 - 21	1.3 J	3.6	C	N	BSV
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/8	0.74 - 35	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/7	0.47 - 310	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/7	3 - 210	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/8	0.63 - 190	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/7	0.92 - 49	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/8	0.64 - 28	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/8	0.7 - 19	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/7	0.67 - 49	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/7	0.73 - 40	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	3.9 J	380 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	4/8	2.9 - 200	380 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/8	3.4 - 620	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/8	3.1 - 560	N/A	3300000	N	N	ND
67-64-1	Acetone	24	770 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	4/8	17 - 38	770 J	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/8	0.58 - 19	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/8	0.56 - 66	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/8	2 - 250	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/7	0.81 - 390	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/7	0.96 - 250	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/8	2.7 - 42	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/8	0.76 - 82	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/8	1 - 350	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/8	0.65 - 21	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/8	0.86 - 150	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	1.2 J	28 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	2/8	0.54 - 21	28 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/8	1.2 - 87	N/A	1800	C	N	ND
110-82-7	Cyclohexane	1400 J	1400 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	1/8	1.1 - 200	1400 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/8	2.3 - 270	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/7	0.78 - 1.7	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	65 J	65 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	1/8	0.86 - 190	65 J	5800	C	N	BSV
98-82-8	Isopropyl benzene	150 J	150 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	1/8	0.69 - 48	150 J	190000	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/8	2.8 - 1200	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	350 J	5900 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	2/8	1 - 2.2	5900 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/8	0.68 - 87	N/A	47000	C	N	ND
75-09-2	Methylene chloride	980 J	980 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	1/8	9.9 - 900	980 J	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/8	0.95 - 28	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	58 J	58 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	1/8	0.6 - 35	58 J	8100	N	N	BSV
108-88-3	Toluene	320 J	630 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	2/8	0.64 - 1.4	630 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/8	0.38 - 35	N/A	160000	N	N	ND

Table 2.17

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/8	0.85 - 250	N/A	1800	C	N	ND
79-01-6	Trichloroethene	2.7 J	81 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	4/8	0.52 - 30	81 J	410	N	N	BSV
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/8	0.89 - 110	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/8	1.1 - 160	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/8	0.69 - 23	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	510 J	2300 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	2/8	1.3 - 2.9	2300 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether	ND	ND	µg/kg	--	0/8	11 - 57	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/8	74 - 390	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/8	69 - 360	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/8	47 - 250	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/8	43 - 230	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/8	150 - 810	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/8	67 - 350	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/8	60 - 320	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/8	15 - 80	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/8	11 - 57	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	15 J	3200 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	8/8	--	3200 J	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/8	33 - 180	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/8	43 - 230	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/8	14 - 74	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	420 J	420 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	1/8	31 - 85	420 J	320000 (5)	N	N	BSV
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/7	47 - 240	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/8	53 - 280	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/8	86 - 450	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/8	15 - 80	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/8	48 - 260	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/8	32 - 170	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/8	15 - 80	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/8	64 - 340	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/8	100 - 530	N/A	--		N	ND
83-32-9	Acenaphthene	11 J	190	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	4/8	3.1 - 3.4	190	360000	N	N	BSV
208-96-8	Acenaphthylene	5.0 J	110	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	4/8	4.3 - 23	110	360000 (5)	N	N	BSV
98-86-2	Acetophenone	22 J	210 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	2/8	12 - 32	210 J	780000	N	N	BSV
120-12-7	Anthracene	9.3 J	200 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	6/8	2.7 - 2.9	200 J	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/8	39 - 200	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	35 J	330 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	2/8	25 - 130	330 J	170000	N	N	BSV
56-55-3	Benzo(a)anthracene	5.3 J	610	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	610	1100	C	N	BSV
50-32-8	**Benzo(a)pyrene**	**27**	**750**	**µg/kg**	**SS-62: 0.17-2.17 ft BGS (10/30/2018)**	**6/8**	**11 - 53**	**750**	**110**	**C**	**Y**	**ASV**
205-99-2	Benzo(b)fluoranthene	9.4 J	1100	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	1100	1100	C	N	BSV

Table 2.17

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	9.4 J	510	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	7/8	40	510	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	9.5 J	390	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	5/8	7.7 - 39	390	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	34 J	250 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	3/8	19 - 20	250 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/8	13 - 68	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/8	13 - 68	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	67 J	450	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	4/8	57 - 150	450	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/8	24 - 120	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/8	80 - 430	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**32 J**	**140 J**	**µg/kg**	**SS-65: 0.25-2.25 ft BGS (10/30/2018)**	**3/8**	**21 - 110**	**140 J**	**--**		**Y**	**AD**
218-01-9	Chrysene	10 J	730	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	730	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**13 J**	**130**	**µg/kg**	**SS-62: 0.17-2.17 ft BGS (10/30/2018)**	**5/8**	**7.7 - 39**	**130**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	54 J	990 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	4/8	14 - 16	990 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/8	33 - 180	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/8	15 - 80	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	140 J	140 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	1/8	24 - 64	140 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/8	30 - 160	N/A	63000	N	N	ND
206-44-0	Fluoranthene	5.6 J	960	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	960	240000	N	N	BSV
86-73-7	Fluorene	14 J	330	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	4/8	3 - 3.3	330	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/8	3.1 - 16	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/8	13 - 68	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/7	67 - 350	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/8	9.7 - 51	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	17	470	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	6/8	8.8 - 42	470	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/8	13 - 68	N/A	570000	C	N	ND
91-20-3	Naphthalene	6.1 J	1500 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	8/8	--	1500 J	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/8	14 - 74	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/8	12 - 62	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/8	13 - 68	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/8	62 - 330	N/A	1000	C	N	ND
85-01-8	Phenanthrene	28	2300 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	8/8	--	2300 J	180000 (5)	N	N	BSV
108-95-2	Phenol	87 J	87 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	1/8	8.6 - 23	87 J	1900000	N	N	BSV
129-00-0	Pyrene	7.0 J	1000	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	1000	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**840**	**7900**	**mg/kg**	**SS-67: 0.17-2.17 ft BGS (10/30/2018)**	**8/8**	**--**	**7900**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.12 J	1.7 J	mg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	8/8	--	1.7 J	3.1	N	N	BSV
7440-38-2	**Arsenic**	**1.7**	**46 J**	**mg/kg**	**SS-65: 0.25-2.25 ft BGS (10/30/2018)**	**8/8**	**--**	**46 J**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	14	560 J	mg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	8/8	--	560 J	1500	N	N	BSV
7440-41-7	Beryllium	0.19	1.5 J	mg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	7/8	0.087	1.5 J	16	N	N	BSV
7440-43-9	Cadmium	0.2	0.4	mg/kg	SS-67: 0.17-2.17 ft BGS (10/30/2018)	6/8	0.09 - 0.098	0.4	7.1	N	N	BSV
7440-70-2	Calcium	740	130000	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	130000	--		N	NAT
16065-83-1	Chromium III (trivalent)	7	39	mg/kg	SS-63: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	39	12000	N	N	BSV

Table 2.17

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	Chromium VI (hexavalent)	ND	ND	mg/kg	--	0/8	0.26 - 0.35	N/A	0.3	C	N	ND
7440-48-4	**Cobalt**	**0.76**	**7.1**	**mg/kg**	**SS-67: 0.17-2.17 ft BGS (10/30/2018)**	**8/8**	**--**	**7.1**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	11	79	mg/kg	SS-67: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	79	310	N	N	BSV
57-12-5	Cyanide (total)	0.31 J	1.4	mg/kg	SS-64: 0-2 ft BGS (10/30/2018)	2/8	0.21 - 0.25	1.4	2.3	N	N	BSV
7439-89-6	**Iron**	**4400**	**12000**	**mg/kg**	**SS-67: 0.17-2.17 ft BGS (10/30/2018)**	**8/8**	**--**	**12000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	8.0 J	110	mg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	110	400	C	N	BSV
7439-92-1	Lead - coarse fraction	80	80	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	1/1	--	80	400	C	N	BSV
7439-92-1	Lead - fine fraction	200	200	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	1/1	--	200	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	92	92	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	1/1	--	92	400	C	N	BSV
7439-95-4	Magnesium	330 J	55000	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	55000	--		N	NAT
7439-96-5	**Manganese**	**15**	**410**	**mg/kg**	**SS-68: 0.17-2.17 ft BGS (10/30/2018)**	**8/8**	**--**	**410**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.018 J	0.41	mg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	5/8	0.022 - 0.023	0.41	1.1	N	N	BSV
7440-02-0	Nickel	8.6	22	mg/kg	SS-64: 0-2 ft BGS (10/30/2018)	8/8	--	22	150	N	N	BSV
7440-09-7	Potassium	170 J	880	mg/kg	SS-67: 0.17-2.17 ft BGS (10/30/2018)	7/8	51	880	--		N	NAT
7782-49-2	Selenium	0.16 J	4.8 J	mg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	7/8	0.11	4.8 J	39	N	N	BSV
7440-22-4	Silver	0.021 J	0.15 J	mg/kg	SS-67: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	0.15 J	39	N	N	BSV
7440-23-5	Sodium	85 J	480	mg/kg	SS-67: 0.17-2.17 ft BGS (10/30/2018)	6/8	47 - 53	480	--		N	NAT
7440-28-0	**Thallium**	**0.14 J**	**0.7**	**mg/kg**	**SS-65: 0.25-2.25 ft BGS (10/30/2018)**	**5/8**	**0.044 - 0.086**	**0.7**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**1.6**	**49 J**	**mg/kg**	**SS-65: 0.25-2.25 ft BGS (10/30/2018)**	**8/8**	**--**	**49 J**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	15 J	150 J	mg/kg	SS-64: 0-2 ft BGS (10/30/2018)	8/8	--	150 J	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/8	24 - 32	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/8	26 - 35	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/8	25 - 34	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/8	20 - 28	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/8	26 - 35	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**210**	**210**	**µg/kg**	**SS-62: 0.17-2.17 ft BGS (10/30/2018)**	**1/8**	**25 - 34**	**210**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/8	24 - 32	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/8	1.6 - 22	N/A	190	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/8	1.6 - 22	N/A	2000	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/kg	--	0/8	1.2 - 16	N/A	1900	C	N	ND
309-00-2	Aldrin	ND	ND	µg/kg	--	0/8	0.82 - 11	N/A	39	C	N	ND
319-84-6	alpha-BHC	10	10	µg/kg	SS-68: 0.17-2.17 ft BGS (10/30/2018)	1/8	0.97 - 13	10	86	C	N	BSV
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/8	1.6 - 22	N/A	1700	C	N	ND
319-85-7	beta-BHC	8.1 NJ	20 NJ	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	2/8	1.8 - 25	20 NJ	300	C	N	BSV
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/8	1.8 - 25	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/8	1.2 - 16	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/8	1.3 - 18	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/8	1.6 - 22	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/8	1.4 - 19	N/A	38000	N	N	ND

Table 2.17

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/8	2 - 28	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/8	1.4 - 19	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/8	0.95 - 13	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/8	1.9 - 26	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/8	1.3 - 18	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/8	1.7 - 23	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/8	1.5 - 21	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/8	7 - 96	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/8	27 - 360	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	16	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/1	18	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/1	62	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	**pg/g**	--	--	--	--	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	--	--	**pg/g**	--	--	--	--	**4.8**	**C**	**Y**	**(6)**
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/1	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-62, SS-63, SS-64, SS-65, SS-66, SS-67, SS-68, SS-69, SS-89, SS-167-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.18

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/16	0.21 - 33	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/13	0.23 - 33	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/16	0.35 - 30	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	1.3 J	1.9 J	µg/kg	BH84-13: 2-4 ft BGS (6/26/2013)	2/16	0.3 - 21	1.9 J	3.6	C	N	BSV
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/16	0.49 - 35	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/13	0.22 - 310	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/13	0.61 - 210	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/16	0.31 - 190	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/13	0.2 - 49	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/16	0.26 - 28	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/16	0.28 - 19	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	2.4 J	2.4 J	µg/kg	TT-10: 10 ft BGS (10/3/2008)	1/14	0.26 - 49	2.4 J	180000 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	2.6 J	8.6 J	µg/kg	TT-10: 10- ft BGS (10/3/2008)	3/15	0.31 - 40	8.6 J	2600	C	N	BSV
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	3.9 J	380 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	6/16	1.1 - 200	380 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/16	0.52 - 620	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/16	0.8 - 560	N/A	3300000	N	N	ND
67-64-1	Acetone	24	770 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	7/15	2.8 - 94	770 J	6100000	N	N	BSV
71-43-2	Benzene	0.32 J	0.98 J	µg/kg	BH112-17: 13-15 ft BGS (12/19/2017)	2/16	0.29 - 19	0.98 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/16	0.3 - 66	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/16	0.36 - 250	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/15	0.53 - 390	N/A	680	N	N	ND
75-15-0	Carbon disulfide	1.2 J	2.8 J	µg/kg	BH83-13: 5-7.5 ft BGS (6/24/2013)	2/15	0.19 - 250	2.8 J	77000	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/16	0.22 - 42	N/A	650	C	N	ND
108-90-7	Chlorobenzene	1.4 J	1.4 J	µg/kg	BH84-13: 2-4 ft BGS (6/26/2013)	1/16	0.3 - 82	1.4 J	28000	N	N	BSV
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/16	0.34 - 350	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	0.34 J	0.34 J	µg/kg	BH83-13: 5-7.5 ft BGS (6/24/2013)	1/16	0.21 - 21	0.34 J	320	C	N	BSV
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/16	0.34 - 150	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.79 J	28 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	3/16	0.25 - 21	28 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/16	0.23 - 87	N/A	1800	C	N	ND
110-82-7	Cyclohexane	0.36 J	1400 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	3/16	0.19 - 200	1400 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/16	0.27 - 270	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/15	0.31 - 14	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	0.37 J	65 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	4/16	0.24 - 190	65 J	5800	C	N	BSV
98-82-8	Isopropyl benzene	1.3 J	150 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	2/16	0.18 - 48	150 J	190000	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/16	1.1 - 1200	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	0.42 J	5900 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	4/16	0.21 - 29	5900 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/16	0.24 - 87	N/A	47000	C	N	ND
75-09-2	Methylene chloride	1.9 J	980 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	4/16	0.26 - 900	980 J	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/16	0.24 - 28	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	4.7 J	58 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	3/16	0.33 - 35	58 J	8100	N	N	BSV
108-88-3	Toluene	0.36 J	630 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	7/16	0.31 - 5.3	630 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/16	0.34 - 35	N/A	160000	N	N	ND

Table 2.18

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/16	0.19 - 250	N/A	1800	C	N	ND
79-01-6	Trichloroethene	2.7 J	81 J	µg/kg	SS-64: 0-2 ft BGS (10/30/2018)	5/16	0.37 - 30	81 J	410	N	N	BSV
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/16	0.22 - 110	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/16	0.44 - 160	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	1.7 J	1.7 J	µg/kg	BH84-13: 2-4 ft BGS (6/26/2013)	1/16	0.25 - 23	1.7 J	59	C	N	BSV
1330-20-7	Xylenes (total)	1.2 J	2300 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	4/16	0.36 - 29	2300 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/14	11 - 160	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/14	29 - 390	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/14	10 - 360	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/14	23 - 250	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/13	23 - 230	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/14	24 - 810	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/14	20 - 350	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/14	24 - 320	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/14	0.52 - 80	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/14	9.4 - 78	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	15 J	3200 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	12/14	0.57 - 10	3200 J	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/14	13 - 310	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/14	10 - 310	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/14	9.5 - 78	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	91 J	420 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	2/11	23 - 85	420 J	320000 (5)	N	N	BSV
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/13	21 - 240	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/14	18 - 310	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/14	11 - 450	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/14	15 - 80	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/14	24 - 260	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/14	20 - 230	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/14	15 - 80	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/14	30 - 340	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/14	20 - 530	N/A	--		N	ND
83-32-9	Acenaphthene	11 J	190	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	6/14	0.87 - 10	190	360000	N	N	BSV
208-96-8	Acenaphthylene	4.3 J	110	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	6/14	1.1 - 23	110	360000 (5)	N	N	BSV
98-86-2	Acetophenone	22 J	210 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	3/14	11 - 160	210 J	780000	N	N	BSV
120-12-7	Anthracene	9.3 J	240	µg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	8/14	0.9 - 10	240	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/14	10 - 310	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	35 J	330 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	3/14	14 - 160	330 J	170000	N	N	BSV
56-55-3	Benzo(a)anthracene	5.3 J	860	µg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	12/14	10	860	1100	C	N	BSV
50-32-8	**Benzo(a)pyrene**	**16**	**770**	**µg/kg**	**BH111-18: 7.5-9.5 ft BGS (1/11/2018)**	**9/14**	**2 - 53**	**770**	**110**	**C**	**Y**	**ASV**
205-99-2	Benzo(b)fluoranthene	9.4 J	1100	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	11/14	1.8 - 10	1100	1100	C	N	BSV

Table 2.18

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	9.4 J	510	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	10/14	1.1 - 40	510	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	8.5	480	µg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	8/14	2.1 - 39	480	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	34 J	250 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	4/14	4 - 78	250 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/14	13 - 160	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/14	2.3 - 160	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	54 J	620	µg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	7/14	51 - 150	620	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/14	11 - 120	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/14	42 - 510	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**32 J**	**140 J**	**µg/kg**	**SS-65: 0.25-2.25 ft BGS (10/30/2018)**	**3/14**	**21 - 110**	**140 J**	**--**		**Y**	**AD**
218-01-9	Chrysene	10 J	870	µg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	12/14	10	870	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**13 J**	**130**	**µg/kg**	**SS-62: 0.17-2.17 ft BGS (10/30/2018)**	**6/14**	**0.76 - 39**	**130**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	26 J	990 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	6/14	0.76 - 78	990 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	42 J	42 J	µg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	1/14	33 - 180	42 J	5100000	N	N	BSV
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/14	15 - 80	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	26 J	140 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	3/14	24 - 78	140 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/14	9.1 - 160	N/A	63000	N	N	ND
206-44-0	Fluoranthene	5.6 J	1800	µg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	12/14	10	1800	240000	N	N	BSV
86-73-7	Fluorene	14 J	330	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	6/14	0.61 - 10	330	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/14	2.4 - 16	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/14	6.4 - 78	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/13	9.3 - 510	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/14	9.7 - 78	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	11	470	µg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	9/14	1.1 - 42	470	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/14	13 - 78	N/A	570000	C	N	ND
91-20-3	Naphthalene	6.1 J	1500 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	11/14	0.94 - 10	1500 J	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/14	2.5 - 160	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/14	7.2 - 78	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/14	13 - 78	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/14	10 - 330	N/A	1000	C	N	ND
85-01-8	Phenanthrene	11	2300 J	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	13/14	10	2300 J	180000 (5)	N	N	BSV
108-95-2	Phenol	87 J	87 J	µg/kg	SS-69: 0.33-2.33 ft BGS (10/30/2018)	1/14	8.4 - 78	87 J	1900000	N	N	BSV
129-00-0	Pyrene	7.0 J	1400	µg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	12/14	10	1400	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**840**	**10000 J**	**mg/kg**	**BH111-18: 7.5-9.5 ft BGS (1/11/2018)**	**14/14**	**--**	**10000 J**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.12 J	2.1 J	mg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	14/14	--	2.1 J	3.1	N	N	BSV
7440-38-2	**Arsenic**	**1.7**	**51.2**	**mg/kg**	**TT-10: 15- ft BGS (10/3/2008)**	**14/14**	**--**	**51.2**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	14	761	mg/kg	TT-10: 15- ft BGS (10/3/2008)	14/14	--	761	1500	N	N	BSV
7440-41-7	Beryllium	0.11 J	1.5	mg/kg	TT-10: 15- ft BGS (10/3/2008)	13/14	0.087	1.5	16	N	N	BSV
7440-43-9	Cadmium	0.090 J	2.1	mg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	10/14	0.09 - 0.78	2.1	7.1	N	N	BSV
7440-70-2	Calcium	740	130000	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	14/14	--	130000	--		N	NAT
16065-83-1	Chromium III (trivalent)	6.8	83	mg/kg	BH112-17: 13-15 ft BGS (12/19/2017)	14/14	--	83	12000	N	N	BSV

Table 2.18

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**1.1**	**2.4**	**mg/kg**	**TT-10: 15- ft BGS (10/3/2008)**	**3/14**	**0.26 - 1.5**	**2.4**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**0.76**	**7.1**	**mg/kg**	**SS-67: 0.17-2.17 ft BGS (10/30/2018)**	**14/14**	**--**	**7.1**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	11	220	mg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	14/14	--	220	310	N	N	BSV
57-12-5	Cyanide (total)	0.074 J	1.5	mg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	5/14	0.21 - 0.78	1.5	2.3	N	N	BSV
7439-89-6	**Iron**	**4400**	**38000**	**mg/kg**	**BH112-17: 13-15 ft BGS (12/19/2017)**	**14/14**	**--**	**38000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	8.0 J	180	mg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	14/14	--	180	400	C	N	BSV
7439-92-1	Lead - coarse fraction	80	80	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	1/1	--	80	400	C	N	BSV
7439-92-1	Lead - fine fraction	200	200	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	1/1	--	200	400	C	N	BSV
7439-92-1	Lead - total (calculated by fine/coarse fraction)	92	92	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	1/1	--	92	400	C	N	BSV
7439-95-4	Magnesium	325 J	55000	mg/kg	SS-66: 0.17-2.17 ft BGS (10/30/2018)	14/14	--	55000	--		N	NAT
7439-96-5	**Manganese**	**13.5**	**2600**	**mg/kg**	**BH112-17: 13-15 ft BGS (12/19/2017)**	**14/14**	**--**	**2600**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.018 J	0.41	mg/kg	SS-62: 0.17-2.17 ft BGS (10/30/2018)	9/14	0.018 - 0.023	0.41	1.1	N	N	BSV
7440-02-0	Nickel	8.2	39	mg/kg	BH112-17: 13-15 ft BGS (12/19/2017)	14/14	--	39	150	N	N	BSV
7440-09-7	Potassium	86 J	1300	mg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	13/14	51	1300	--		N	NAT
7782-49-2	Selenium	0.14 J	7.7 J	mg/kg	TT-10: 10- ft BGS (10/3/2008)	13/14	0.11	7.7 J	39	N	N	BSV
7440-22-4	Silver	0.021 J	0.21	mg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	11/14	1.2 - 1.6	0.21	39	N	N	BSV
7440-23-5	Sodium	85 J	700	mg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	8/14	47 - 776	700	--		N	NAT
7440-28-0	**Thallium**	**0.14 J**	**1.1**	**mg/kg**	**TT-10: 15- ft BGS (10/3/2008)**	**9/14**	**0.044 - 0.76**	**1.1**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**1.6**	**49 J**	**mg/kg**	**SS-65: 0.25-2.25 ft BGS (10/30/2018)**	**14/14**	**--**	**49 J**	**39**	**N**	**Y**	**ASV**
7440-66-6	Zinc	12.1	440	mg/kg	BH111-18: 7.5-9.5 ft BGS (1/11/2018)	14/14	--	440	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/14	24 - 51	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/14	26 - 51	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/14	25 - 51	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/14	20 - 51	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/14	26 - 51	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**150**	**210**	**µg/kg**	**SS-62: 0.17-2.17 ft BGS (10/30/2018)**	**2/14**	**25 - 51**	**210**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/14	24 - 51	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	5.0 J	5.0 J	µg/kg	BH113-18: 9-11 ft BGS (1/3/2018)	1/14	1.6 - 41	5.0 J	190	C	N	BSV
72-55-9	4,4'-DDE	1.4 J	27 J	µg/kg	TT-10: 5 ft BGS (10/3/2008)	3/14	1.3 - 22	27 J	2000	C	N	BSV
50-29-3	4,4'-DDT	ND	ND	µg/kg	--	0/14	1.2 - 41	N/A	1900	C	N	ND
309-00-2	Aldrin	ND	ND	µg/kg	--	0/14	0.82 - 41	N/A	39	C	N	ND
319-84-6	alpha-BHC	10	10	µg/kg	SS-68: 0.17-2.17 ft BGS (10/30/2018)	1/14	0.97 - 41	10	86	C	N	BSV
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/14	1.6 - 41	N/A	1700	C	N	ND
319-85-7	beta-BHC	8.1 NJ	20 NJ	µg/kg	SS-65: 0.25-2.25 ft BGS (10/30/2018)	2/14	1.8 - 41	20 NJ	300	C	N	BSV
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/14	1.4 - 41	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/14	0.98 - 41	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/14	1.3 - 41	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/14	1.6 - 41	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/14	1.3 - 41	N/A	38000	N	N	ND

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Moraine, Ohio

Medium: EU12 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/14	1.5 - 41	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/14	1.4 - 45	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	1.1 J	1.1 J	µg/kg	TT-10: 15 ft BGS (10/3/2008)	1/14	0.95 - 41	1.1 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/14	1.9 - 41	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/14	1.3 - 41	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/14	0.85 - 41	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/14	1.5 - 41	N/A	70	C	N	ND
72-43-5	Methoxychlor	1.5 NJ	5.5 J	µg/kg	BH113-18: 9-11 ft BGS (1/3/2018)	2/14	1.5 - 96	5.5 J	32000	N	N	BSV
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/14	27 - 1600	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	16	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/4	18 - 31	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/4	62 - 120	N/A	70000	N	N	ND
	Dioxins/Furans											
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	4.0 J	4.0 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	4.0 J	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	79 J	79 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	79 J	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	1.7 J	1.7 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	1.7 J	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	4.8 J	4.8 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	4.8 J	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	ND	ND	pg/g	--	0/1	0.21	N/A	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/1	0.22	N/A	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	ND	ND	pg/g	--	0/1	0.097	N/A	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/1	0.2	N/A	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.61 J	0.61 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	0.61 J	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/1	0.24	N/A	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.37 J	0.37 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	0.37 J	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	ND	ND	pg/g	--	0/1	0.076	N/A	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ND	ND	pg/g	--	0/1	0.064	N/A	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/1	0.2	N/A	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	ND	ND	pg/g	--	0/1	0.073	N/A	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.69 J	0.69 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	0.69 J	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ND	ND	pg/g	--	0/1	0.12	N/A	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	5.8 J	5.8 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	5.8 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	9.8 J	9.8 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	9.8 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	1.8 J	1.8 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	1.8 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	4.0 J	4.0 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	4.0 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	3.5 J	3.5 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	3.5 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	0.94 J	0.94 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	0.94 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	7.3 J	7.3 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	7.3 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	0.45 J	0.45 J	pg/g	BH112-17: 13-15 ft BGS (12/19/2017)	1/1	--	0.45 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**0.2569**	**0.2569**	**pg/g**	**BH112-17: 13-15 ft BGS (12/19/2017)**	**1/1**	**--**	**0.2569**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**0.40989**	**0.40989**	**pg/g**	**BH112-17: 13-15 ft BGS (12/19/2017)**	**1/1**	**--**	**0.40989**	**4.8**	**C**	**Y**	**(6)**

Table 2.18

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU12 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos										
1332-21-4	Asbestos	ND	ND	%	--	0/2	0.25 - 1	N/A	--	N	ND
12001-29-5	Chrysotile asbestos	ND	ND	%	--	0/2	1	N/A	--	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH83-13, BH84-13, BH111-18, BH112-18, BH113-18, SS-62, SS-63, SS-64, SS-65, SS-66, SS-67, SS-68, SS-69, SS-89, SS-167-AS, TT-10.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.19

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	2.1 J	2.1 J	µg/kg	SS-55: 0-2 ft BGS (10/29/2018)	1/8	0.84 - 49	2.1 J	810000	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/7	0.95 - 49	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/8	1.3 - 45	N/A	150	N	N	ND
75-34-3	**1,1-Dichloroethane**	**25 J**	**25 J**	**µg/kg**	**SS-55: 0-2 ft BGS (10/29/2018)**	**1/8**	**0.81 - 31**	**25 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/8	1.1 - 52	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/7	0.88 - 460	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/7	2.5 - 310	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/8	0.9 - 270	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/7	0.81 - 73	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/8	0.9 - 42	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/8	0.99 - 28	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/7	1.1 - 73	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/7	1.3 - 59	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	22 J	510 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	2/9	4.1 - 550	510 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/8	2.1 - 910	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/8	3.3 - 830	N/A	3300000	N	N	ND
67-64-1	Acetone	1200 J	1200 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/9	11 - 850	1200 J	6100000	N	N	BSV
71-43-2	Benzene	190 J	190 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/9	0.81 - 28	190 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/8	0.79 - 97	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/8	1.5 - 370	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/8	1.1 - 580	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/8	0.77 - 380	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/8	0.92 - 63	N/A	650	C	N	ND
108-90-7	Chlorobenzene	920 J	920 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/9	1.1 - 120	920 J	28000	N	N	BSV
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/8	1.4 - 520	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	0.40 J	0.40 J	µg/kg	BH74-13: 0-2 ft BGS (6/20/2013)	1/8	0.84 - 31	0.40 J	320	C	N	BSV
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/8	1.2 - 230	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	32 J	390 J	µg/kg	SS-57: 0.25-2.25 ft BGS (10/30/2018)	4/9	0.76 - 31	390 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/8	0.95 - 130	N/A	1800	C	N	ND
110-82-7	Cyclohexane	1400 J	1400 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/9	0.77 - 570	1400 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/8	1.1 - 410	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/4	1.1 - 180	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	4000 J	4000 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/9	0.99 - 46	4000 J	5800	C	N	BSV
98-82-8	Isopropyl benzene	2700 J	2700 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/9	0.73 - 130	2700 J	190000	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/8	4 - 1800	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	3.7 J	11000 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	2/9	0.84 - 230	11000 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/8	0.95 - 130	N/A	47000	C	N	ND
75-09-2	Methylene chloride	8.9 J	8.9 J	µg/kg	BH74-13: 0-2 ft BGS (6/20/2013)	1/8	0.88 - 1300	8.9 J	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/8	0.99 - 42	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	230 J	7200 J	µg/kg	SS-60: 0.17-2.17 ft BGS (10/30/2018)	2/8	0.85 - 55	7200 J	8100	N	N	BSV
108-88-3	Toluene	3.1 J	1100 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	2/9	0.9 - 290	1100 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	10 J	66 J	µg/kg	SS-57: 0.25-2.25 ft BGS (10/30/2018)	2/8	0.54 - 52	66 J	160000	N	N	BSV

Table 2.19

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/8	0.77 - 360	N/A	1800	C	N	ND
79-01-6	**Trichloroethene**	**3.3 J**	**13000 J**	**µg/kg**	**SS-57: 0.25-2.25 ft BGS (10/30/2018)**	**7/8**	**1.5**	**13000 J**	**410**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/8	0.88 - 160	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/8	1.5 - 230	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	4.9 J	4.9 J	µg/kg	SS-55: 0-2 ft BGS (10/29/2018)	1/8	0.97 - 35	4.9 J	59	C	N	BSV
1330-20-7	Xylenes (total)	120 J	14000 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	2/9	1.5 - 80	14000 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/8	11 - 910	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/8	35 - 6300	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/8	12 - 5800	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/8	28 - 4000	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/8	28 - 3600	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/8	29 - 13000	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/8	24 - 5600	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/8	29 - 5100	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/8	0.63 - 1300	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/8	11 - 910	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	5.0 J	8600	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	8/8	3.3	8600	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/8	15 - 2800	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/8	13 - 3600	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/8	12 - 1200	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/8	28 - 2600	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/8	25 - 3900	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/8	22 - 4500	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/8	13 - 7300	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/8	15 - 1300	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/8	29 - 4100	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/8	24 - 2700	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/8	15 - 1300	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/8	36 - 5500	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/8	24 - 8600	N/A	--		N	ND
83-32-9	Acenaphthene	340 J	590	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	2/8	1.1 - 12	590	360000	N	N	BSV
208-96-8	Acenaphthylene	6.1 J	190	µg/kg	SS-61: 0-2 ft BGS (10/30/2018)	3/8	0.49 - 370	190	360000 (5)	N	N	BSV
98-86-2	Acetophenone	17 J	43 J	µg/kg	SS-58: 0-2 ft BGS (11/3/2017)	3/8	12 - 1000	43 J	780000	N	N	BSV
120-12-7	Anthracene	9.7 J	1700	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	5/8	1.1 - 220	1700	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/8	13 - 3300	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	55 J	55 J	µg/kg	SS-58: 0-2 ft BGS (11/3/2017)	1/8	25 - 2100	55 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**30**	**5200**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**7/8**	**5.1 - 5.7**	**5200**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**15 J**	**5200**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**7/8**	**16 - 850**	**5200**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**10 J**	**8000**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**8/8**	**11**	**8000**	**1100**	**C**	**Y**	**ASV**

Table 2.19

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	33	3600	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	6/8	11 - 650	3600	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	11 J	3000	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	6/8	10 - 630	3000	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	19 J	65 J	µg/kg	SS-58: 0-2 ft BGS (11/3/2017)	3/8	20 - 1500	65 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/8	13 - 1100	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/8	2.8 - 1100	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	78	10000	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	4/8	48 - 620	10000	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/8	14 - 2000	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/8	52 - 6800	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**21 J**	**1100**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**3/8**	**22 - 1700**	**1100**	**--**		**Y**	**AD**
218-01-9	Chrysene	12 J	5700	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	8/8	2.5	5700	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**15 J**	**920**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**4/8**	**0.93 - 630**	**920**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	18 J	430 J	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	6/8	20 - 1200	430 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/8	22 - 2800	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/8	15 - 1300	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	37 J	3600 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	3/8	24 - 270	3600 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/8	11 - 2500	N/A	63000	N	N	ND
206-44-0	Fluoranthene	15 J	11000	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	8/8	7.4	11000	240000	N	N	BSV
86-73-7	Fluorene	6.1 J	580	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	5/8	0.74 - 4.6	580	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/8	2.9 - 260	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/8	7.9 - 1100	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/8	11 - 5600	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/8	9.9 - 820	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**17**	**3100**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**5/8**	**9.8 - 670**	**3100**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/8	13 - 1100	N/A	570000	C	N	ND
91-20-3	**Naphthalene**	**31 J**	**4200**	**µg/kg**	**SS-59: 0-2 ft BGS (10/30/2018)**	**7/8**	**3.6 - 4**	**4200**	**3800**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/8	3.1 - 1200	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/8	8.8 - 1000	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/8	13 - 1100	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/8	13 - 5300	N/A	1000	C	N	ND
85-01-8	Phenanthrene	17 J	7800	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	8/8	3.7	7800	180000 (5)	N	N	BSV
108-95-2	Phenol	6600	6600	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/8	8.8 - 97	6600	1900000	N	N	BSV
129-00-0	Pyrene	15 J	8900	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	8/8	3.6	8900	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**1700 J**	**8400**	**mg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**8400**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.59 J**	**1400 J**	**mg/kg**	**SS-54: 0.25-2.25 ft BGS (10/30/2018)**	**7/8**	**0.33**	**1400 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**3.6**	**70**	**mg/kg**	**SS-60: 0.17-2.17 ft BGS (10/30/2018)**	**8/8**	**--**	**70**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**55**	**1800**	**mg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**1800**	**1500**	**N**	**Y**	**ASV**
7440-41-7	Beryllium	0.42	6	mg/kg	SS-55: 0-2 ft BGS (10/29/2018)	8/8	--	6	16	N	N	BSV
7440-43-9	**Cadmium**	**0.10 J**	**30**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**7/8**	**0.16**	**30**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	1400	120000	mg/kg	SS-59: 0-2 ft BGS (10/30/2018)	8/8	--	120000	--		N	NAT
16065-83-1	Chromium III (trivalent)	3	370	mg/kg	SS-61: 0-2 ft BGS (10/30/2018)	8/8	--	370	12000	N	N	BSV

Table 2.19

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.5**	**1.4**	**mg/kg**	**SS-57: 0.25-2.25 ft BGS (10/30/2018)**	**3/8**	**0.26 - 1.6**	**1.4**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**2.2**	**24**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**24**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**12**	**3300**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**3300**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.38 J**	**4.1**	**mg/kg**	**SS-60: 0.17-2.17 ft BGS (10/30/2018)**	**6/8**	**0.22 - 0.33**	**4.1**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**4800**	**180000**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**180000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**2.9**	**26000 J**	**mg/kg**	**SS-54: 0.25-2.25 ft BGS (10/30/2018)**	**8/8**	**--**	**26000 J**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - coarse fraction**	**980**	**6300**	**mg/kg**	**SS-59: 0-2 ft BGS (10/30/2018)**	**2/2**	**--**	**6300**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - fine fraction**	**1500**	**5300**	**mg/kg**	**SS-59: 0-2 ft BGS (10/30/2018)**	**2/2**	**--**	**5300**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - total (calculated by fine/coarse fraction)**	**35**	**1100**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**2/2**	**--**	**1100**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	290	38000	mg/kg	SS-59: 0-2 ft BGS (10/30/2018)	8/8	--	38000	--		N	NAT
7439-96-5	**Manganese**	**19**	**2300**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**2300**	**180**	**N**	**Y**	**ASV**
7439-97-6	**Mercury**	**0.039 J**	**3.2**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**3.2**	**1.1**	**N**	**Y**	**ASV**
7440-02-0	**Nickel**	**6**	**310**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**310**	**150**	**N**	**Y**	**ASV**
7440-09-7	Potassium	320	1100	mg/kg	SS-61: 0-2 ft BGS (10/30/2018)	7/8	210	1100	--		N	NAT
7782-49-2	Selenium	0.16 J	4	mg/kg	SS-60: 0.17-2.17 ft BGS (10/30/2018)	8/8	--	4	39	N	N	BSV
7440-22-4	Silver	0.018 J	28	mg/kg	SS-56: 0-2 ft BGS (10/30/2018)	8/8	--	28	39	N	N	BSV
7440-23-5	Sodium	140 J	1500	mg/kg	SS-61: 0-2 ft BGS (10/30/2018)	7/8	60	1500	--		N	NAT
7440-28-0	**Thallium**	**0.14 J**	**2**	**mg/kg**	**SS-60: 0.17-2.17 ft BGS (10/30/2018)**	**7/8**	**0.067**	**2**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**7.8**	**130**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**130**	**39**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**14**	**3400 J**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**8/8**	**--**	**3400 J**	**2300**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/8	23 - 2200	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/8	25 - 2400	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/8	23 - 2300	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/8	20 - 1900	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/8	24 - 2400	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**49 J**	**140000**	**µg/kg**	**SS-59: 0-2 ft BGS (10/30/2018)**	**6/8**	**20 - 26**	**140000**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	54 J	110	µg/kg	SS-54: 0.25-2.25 ft BGS (10/30/2018)	1/8	23 - 2200	110	240	C	N	BSV
	Pesticides											
72-54-8	4,4'-DDD	34 NJ	43 J	µg/kg	SS-55: 0-2 ft BGS (10/29/2018)	1/8	1.6 - 150	43 J	190	C	N	BSV
72-55-9	4,4'-DDE	280	280	µg/kg	SS-60: 0.17-2.17 ft BGS (10/30/2018)	1/8	1.6 - 150	280	2000	C	N	BSV
50-29-3	4,4'-DDT	3.5 NJ	760	µg/kg	SS-60: 0.17-2.17 ft BGS (10/30/2018)	4/8	12 - 120	760	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/8	0.84 - 79	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/8	0.99 - 93	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/8	1.6 - 150	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/8	1.9 - 180	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/8	1.8 - 170	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/8	1.2 - 110	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/8	1.3 - 120	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/8	1.6 - 150	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/8	1.4 - 130	N/A	38000	N	N	ND

Table 2.19

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/8	2.1 - 190	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	280 J	280 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/8	1.4 - 35	280 J	1900	N	N	BSV
53494-70-5	Endrin ketone	17 J	17 J	µg/kg	SS-55: 0-2 ft BGS (10/29/2018)	1/8	0.97 - 91	17 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/8	1.9 - 180	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/8	1.3 - 130	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/8	1.7 - 160	N/A	130	C	N	ND
1024-57-3	**Heptachlor epoxide**	**75 NJ**	**75 NJ**	**µg/kg**	**SS-60: 0.17-2.17 ft BGS (10/30/2018)**	**1/8**	**1.6 - 150**	**75 NJ**	**70**	**C**	**Y**	**ASV**
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/8	7.1 - 670	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/8	27 - 2600	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	17	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/1	18	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/1	63	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**
	Asbestos											
12001-29-5	Chrysotile asbestos	ND	ND	%	--	0/1	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH74-13, SS-54, SS-55, SS-56, SS-57, SS-58, SS-59, SS-60, SS-61, SS-94, SS-168-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.20

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	2.1 J	54 J	µg/kg	BH109-18: 7.5-9.5 ft BGS (1/16/2018)	2/15	0.24 - 11000	54 J	810000	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/14	0.27 - 11000	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/15	0.41 - 11000	N/A	150	N	N	ND
75-34-3	**1,1-Dichloroethane**	**25 J**	**25 J**	**µg/kg**	**SS-55: 0-2 ft BGS (10/29/2018)**	**1/15**	**0.34 - 11000**	**25 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/15	0.56 - 11000	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	210 J	210 J	µg/kg	BH67-13: 7-9 ft BGS (6/20/2013)	1/14	0.25 - 11000	210 J	5800	N	N	BSV
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/14	0.71 - 23000	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/15	0.36 - 11000	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/14	0.23 - 11000	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/15	0.3 - 11000	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/15	0.32 - 11000	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	170 J	170 J	µg/kg	BH67-13: 7-9 ft BGS (6/20/2013)	1/14	0.3 - 11000	170 J	180000 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/14	0.36 - 11000	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	22 J	510 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	2/16	1.3 - 46000	510 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/15	0.6 - 46000	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/15	0.93 - 46000	N/A	3300000	N	N	ND
67-64-1	Acetone	1200 J	4500 J	µg/kg	BH67-13: 7-9 ft BGS (6/20/2013)	2/16	3.2 - 46000	4500 J	6100000	N	N	BSV
71-43-2	Benzene	190 J	190 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/16	0.33 - 11000	190 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/15	0.34 - 11000	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/15	0.42 - 11000	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/15	0.61 - 11000	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/15	0.22 - 11000	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/15	0.26 - 11000	N/A	650	C	N	ND
108-90-7	Chlorobenzene	320 J	1000 J	µg/kg	BH66-13: 10-12 ft BGS (6/26/2013)	3/16	0.34 - 170	1000 J	28000	N	N	BSV
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/15	0.4 - 11000	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	0.40 J	0.40 J	µg/kg	BH74-13: 0-2 ft BGS (6/20/2013)	1/15	0.24 - 11000	0.40 J	320	C	N	BSV
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/15	0.4 - 11000	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	32 J	890 J	µg/kg	BH67-13: 7-9 ft BGS (6/20/2013)	6/16	0.29 - 11000	890 J	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/15	0.27 - 11000	N/A	1800	C	N	ND
110-82-7	Cyclohexane	85 J	1400 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	2/16	0.22 - 23000	1400 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/15	0.31 - 11000	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/11	0.36 - 11000	N/A	8700	N	N	ND
100-41-4	**Ethylbenzene**	**4000 J**	**59000**	**µg/kg**	**BH67-13: 7-9 ft BGS (6/20/2013)**	**3/16**	**0.28 - 200**	**59000**	**5800**	**C**	**Y**	**ASV**
98-82-8	Isopropyl benzene	45 J	13000	µg/kg	BH66-13: 10-12 ft BGS (6/26/2013)	4/16	0.21 - 200	13000	190000	N	N	BSV
79-20-9	Methyl acetate	650 J	650 J	µg/kg	BH67-13: 7-9 ft BGS (6/20/2013)	1/15	1.2 - 23000	650 J	7800000	N	N	BSV
108-87-2	Methyl cyclohexane	3.7 J	53000	µg/kg	BH66-13: 10-12 ft BGS (6/26/2013)	5/16	0.24 - 230	53000	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/15	0.28 - 11000	N/A	47000	C	N	ND
75-09-2	Methylene chloride	8.9 J	4000	µg/kg	BH67-13: 7-9 ft BGS (6/20/2013)	2/15	0.88 - 20000	4000	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/15	0.28 - 11000	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	230 J	7200 J	µg/kg	SS-60: 0.17-2.17 ft BGS (10/30/2018)	3/15	0.39 - 11000	7200 J	8100	N	N	BSV
108-88-3	Toluene	3.1 J	1400 J	µg/kg	BH67-13: 7-9 ft BGS (6/20/2013)	3/16	0.35 - 11000	1400 J	490000	N	N	BSV

Table 2.20

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
156-60-5	trans-1,2-Dichloroethene	10 J	66 J	µg/kg	SS-57: 0.25-2.25 ft BGS (10/30/2018)	2/15	0.4 - 11000	66 J	160000	N	N	BSV
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/15	0.22 - 11000	N/A	1800	C	N	ND
79-01-6	**Trichloroethene**	**2.8 J**	**13000 J**	**µg/kg**	**SS-57: 0.25-2.25 ft BGS (10/30/2018)**	**11/15**	**1.5 - 11000**	**13000 J**	**410**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/15	0.25 - 11000	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/15	0.51 - 11000	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	4.9 J	4.9 J	µg/kg	SS-55: 0-2 ft BGS (10/29/2018)	1/15	0.29 - 11000	4.9 J	59	C	N	BSV
1330-20-7	**Xylenes (total)**	**45 J**	**140000**	**µg/kg**	**BH66-13: 10-12 ft BGS (6/26/2013)**	**7/16**	**0.42 - 80**	**140000**	**58000**	**N**	**Y**	**ASV**
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether	ND	ND	µg/kg	--	0/13	11 - 910	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/13	30 - 6300	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/13	11 - 5800	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/13	24 - 4000	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	170 J	170 J	µg/kg	BH109-18: 7.5-9.5 ft BGS (1/16/2018)	1/13	24 - 3600	170 J	130000	N	N	BSV
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/13	25 - 13000	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/13	20 - 5600	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/13	25 - 5100	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/13	0.53 - 1300	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/13	9.7 - 910	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	5.0 J	8800	µg/kg	TT-40: 6-8 ft BGS (11/3/2017)	13/13	3.3	8800	240000	N	N	BSV
95-48-7	2-Methylphenol	110 J	110 J	µg/kg	BH109-18: 7.5-9.5 ft BGS (1/16/2018)	1/13	13 - 2800	110 J	320000	N	N	BSV
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/13	11 - 3600	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/13	9.8 - 1200	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/13	24 - 2600	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/13	21 - 3900	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/13	19 - 4500	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/13	11 - 7300	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/13	15 - 1300	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/13	25 - 4100	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/13	20 - 2700	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/13	15 - 1300	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/13	31 - 5500	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/13	20 - 8600	N/A	--		N	ND
83-32-9	Acenaphthene	12	590	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	6/13	1.1 - 12	590	360000	N	N	BSV
208-96-8	Acenaphthylene	4.6 J	190	µg/kg	SS-61: 0-2 ft BGS (10/30/2018)	5/13	0.49 - 370	190	360000 (5)	N	N	BSV
98-86-2	Acetophenone	17 J	340 J	µg/kg	BH109-18: 7.5-9.5 ft BGS (1/16/2018)	4/13	11 - 1000	340 J	780000	N	N	BSV
120-12-7	Anthracene	9.7 J	1700	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	6/13	1.1 - 220	1700	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/13	11 - 3300	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	24 J	55 J	µg/kg	SS-58: 0-2 ft BGS (11/3/2017)	2/13	25 - 2100	55 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**30**	**5200**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**10/13**	**3.5 - 7.6**	**5200**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**15 J**	**5200**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**11/13**	**7.7 - 850**	**5200**	**110**	**C**	**Y**	**ASV**

Table 2.20

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
205-99-2	**Benzo(b)fluoranthene**	**10 J**	**8000**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**12/13**	**7.1 - 11**	**8000**	**1100**	**C**	**Y**	**ASV**
191-24-2	Benzo(g,h,i)perylene	33	3600	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	9/13	4.1 - 650	3600	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	11 J	3000	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	9/13	7.9 - 630	3000	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	19 J	1600	µg/kg	TT-40: 6-8 ft BGS (11/3/2017)	6/13	20 - 1500	1600	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/13	13 - 1100	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/13	2.4 - 1100	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	78	10000	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	7/13	48 - 620	10000	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/13	12 - 2000	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/13	44 - 6800	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**21 J**	**1100**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**4/13**	**22 - 1700**	**1100**	**--**		**Y**	**AD**
218-01-9	Chrysene	12 J	5700	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	11/13	2.5 - 13	5700	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**15 J**	**920**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**5/13**	**0.93 - 630**	**920**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	18 J	1100	µg/kg	BH109-18: 7.5-9.5 ft BGS (1/16/2018)	9/13	3.7 - 1200	1100	7300	N	N	BSV
84-66-2	Diethyl phthalate	19 J	19 J	µg/kg	BH108-18: 7-9 ft BGS (1/12/2018)	1/13	22 - 2800	19 J	5100000	N	N	BSV
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/13	15 - 1300	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	37 J	3600 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	3/13	18 - 270	3600 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/13	9.3 - 2500	N/A	63000	N	N	ND
206-44-0	Fluoranthene	15 J	11000	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	13/13	7.4	11000	240000	N	N	BSV
86-73-7	Fluorene	6.1 J	670	µg/kg	BH110-18: 6.3-8.3 ft BGS (1/16/2018)	9/13	0.74 - 4.6	670	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/13	2.5 - 260	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/13	6.6 - 1100	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/13	9.6 - 5600	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/13	9.9 - 820	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**17**	**3100**	**µg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**8/13**	**4.1 - 670**	**3100**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/13	13 - 1100	N/A	570000	C	N	ND
91-20-3	**Naphthalene**	**31 J**	**11000**	**µg/kg**	**TT-40: 6-8 ft BGS (11/3/2017)**	**11/13**	**3.6 - 4.6**	**11000**	**3800**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/13	2.6 - 1200	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/13	7.4 - 1000	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/13	13 - 1100	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/13	11 - 5300	N/A	1000	C	N	ND
85-01-8	Phenanthrene	17 J	7800	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	13/13	3.7	7800	180000 (5)	N	N	BSV
108-95-2	Phenol	6600	6600	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/13	8.6 - 97	6600	1900000	N	N	BSV
129-00-0	Pyrene	15 J	8900	µg/kg	SS-56: 0-2 ft BGS (10/30/2018)	13/13	3.6	8900	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**1700 J**	**14000**	**mg/kg**	**BH110-18: 6.3-8.3 ft BGS (1/16/2018)**	**13/13**	**--**	**14000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.24 J**	**1400 J**	**mg/kg**	**SS-54: 0.25-2.25 ft BGS (10/30/2018)**	**12/13**	**0.33**	**1400 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**3.6**	**70**	**mg/kg**	**SS-60: 0.17-2.17 ft BGS (10/30/2018)**	**13/13**	**--**	**70**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**55**	**1800**	**mg/kg**	**SS-56: 0-2 ft BGS (10/30/2018)**	**13/13**	**--**	**1800**	**1500**	**N**	**Y**	**ASV**
7440-41-7	Beryllium	0.31	6	mg/kg	SS-55: 0-2 ft BGS (10/29/2018)	13/13	--	6	16	N	N	BSV
7440-43-9	**Cadmium**	**0.10 J**	**30**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**12/13**	**0.16**	**30**	**7.1**	**N**	**Y**	**ASV**

Table 2.20

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
7440-70-2	Calcium	1200	120000	mg/kg	SS-59: 0-2 ft BGS (10/30/2018)	13/13	--	120000	--		N	NAT
16065-83-1	Chromium III (trivalent)	3	370	mg/kg	SS-61: 0-2 ft BGS (10/30/2018)	14/14	--	370	12000	N	N	BSV
18540-29-9	**Chromium VI (hexavalent)**	**0.5**	**2.6**	**mg/kg**	**TT-40: 6-8 ft BGS (11/3/2017)**	**4/14**	**0.26 - 1.6**	**2.6**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**2.2**	**24**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**13/13**	**--**	**24**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**12**	**3300**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**13/13**	**--**	**3300**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.38 J**	**4.1**	**mg/kg**	**SS-60: 0.17-2.17 ft BGS (10/30/2018)**	**8/13**	**0.055 - 0.47**	**4.1**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**4800**	**180000**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**13/13**	**--**	**180000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**2.9**	**26000 J**	**mg/kg**	**SS-54: 0.25-2.25 ft BGS (10/30/2018)**	**13/13**	**--**	**26000 J**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - coarse fraction**	**980**	**6300**	**mg/kg**	**SS-59: 0-2 ft BGS (10/30/2018)**	**2/2**	**--**	**6300**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - fine fraction**	**1500**	**5300**	**mg/kg**	**SS-59: 0-2 ft BGS (10/30/2018)**	**2/2**	**--**	**5300**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - total (calculated by fine/coarse fraction)**	**35**	**1100**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**2/2**	**--**	**1100**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	290	38000	mg/kg	SS-59: 0-2 ft BGS (10/30/2018)	13/13	--	38000	--		N	NAT
7439-96-5	**Manganese**	**19**	**2300**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**13/13**	**--**	**2300**	**180**	**N**	**Y**	**ASV**
7439-97-6	**Mercury**	**0.031 J**	**3.2**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**13/13**	**--**	**3.2**	**1.1**	**N**	**Y**	**ASV**
7440-02-0	**Nickel**	**6**	**310**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**13/13**	**--**	**310**	**150**	**N**	**Y**	**ASV**
7440-09-7	Potassium	320	1400	mg/kg	BH110-18: 6.3-8.3 ft BGS (1/16/2018)	11/13	180 - 210	1400	--		N	NAT
7782-49-2	Selenium	0.16 J	4	mg/kg	SS-60: 0.17-2.17 ft BGS (10/30/2018)	13/13	--	4	39	N	N	BSV
7440-22-4	Silver	0.018 J	28	mg/kg	SS-56: 0-2 ft BGS (10/30/2018)	13/13	--	28	39	N	N	BSV
7440-23-5	Sodium	80 J	1500	mg/kg	SS-61: 0-2 ft BGS (10/30/2018)	11/13	60 - 65	1500	--		N	NAT
7440-28-0	**Thallium**	**0.11 J**	**2**	**mg/kg**	**SS-60: 0.17-2.17 ft BGS (10/30/2018)**	**12/13**	**0.067**	**2**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**5**	**130**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**13/13**	**--**	**130**	**39**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**14**	**3400 J**	**mg/kg**	**SS-61: 0-2 ft BGS (10/30/2018)**	**13/13**	**--**	**3400 J**	**2300**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/15	23 - 2200	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/15	25 - 2400	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/15	18 - 2300	N/A	170	C	N	ND
53469-21-9	**Aroclor-1242 (PCB-1242)**	**380**	**380**	**µg/kg**	**BH66-13: 10-12 ft BGS (6/26/2013)**	**1/15**	**20 - 2000**	**380**	**230**	**C**	**Y**	**ASV**
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/15	19 - 2400	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**49 J**	**140000**	**µg/kg**	**SS-59: 0-2 ft BGS (10/30/2018)**	**11/15**	**20 - 28**	**140000**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	54 J	110	µg/kg	SS-54: 0.25-2.25 ft BGS (10/30/2018)	1/15	20 - 2200	110	240	C	N	BSV
	Pesticides											
72-54-8	4,4'-DDD	34 NJ	43 J	µg/kg	SS-55: 0-2 ft BGS (10/29/2018)	1/13	1.6 - 190	43 J	190	C	N	BSV
72-55-9	4,4'-DDE	280	280	µg/kg	SS-60: 0.17-2.17 ft BGS (10/30/2018)	1/13	1.6 - 150	280	2000	C	N	BSV
50-29-3	4,4'-DDT	3.5 NJ	760	µg/kg	SS-60: 0.17-2.17 ft BGS (10/30/2018)	4/13	8 - 120	760	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/13	0.84 - 130	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/13	0.99 - 93	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/13	1.6 - 210	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/13	1.9 - 220	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/13	1.8 - 170	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/13	1.2 - 110	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/13	1.3 - 120	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/13	1.6 - 150	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/13	1.4 - 130	N/A	38000	N	N	ND

Table 2.20

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/13	2.1 - 190	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	280 J	280 J	µg/kg	SS-59: 0-2 ft BGS (10/30/2018)	1/13	1.4 - 100	280 J	1900	N	N	BSV
53494-70-5	Endrin ketone	17 J	17 J	µg/kg	SS-55: 0-2 ft BGS (10/29/2018)	1/13	0.97 - 91	17 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/13	1.9 - 180	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/13	1.3 - 130	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/13	1.7 - 160	N/A	130	C	N	ND
1024-57-3	**Heptachlor epoxide**	**75 NJ**	**75 NJ**	**µg/kg**	**SS-60: 0.17-2.17 ft BGS (10/30/2018)**	**1/13**	**1.6 - 150**	**75 NJ**	**70**	**C**	**Y**	**ASV**
72-43-5	Methoxychlor	7.1 NJ	7.1 NJ	µg/kg	BH108-18: 7-9 ft BGS (1/12/2018)	1/13	7.1 - 670	7.1 NJ	32000	N	N	BSV
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/13	27 - 2600	N/A	490	C	N	ND
	Dioxins/Furans											
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	13	13	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	13	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	160	160	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	160	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	12	12	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	12	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	23	23	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	23	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.85 J	0.85 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	0.85 J	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	4.2 J	4.2 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	4.2 J	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.43 J	0.43 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	0.43 J	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.7 J	1.7 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	1.7 J	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	3.0 J	3.0 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	3.0 J	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/1	0.047	N/A	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	2.2 J	2.2 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	2.2 J	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	1.1 J	1.1 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	1.1 J	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.52 J	0.52 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	0.52 J	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.5 J	1.5 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	1.5 J	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	2.5 J	2.5 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	2.5 J	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	3.8	3.8	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	3.8	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.21 J	0.21 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	0.21 J	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	27 J	27 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	27 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	46 J	46 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	46 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	28 J	28 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	28 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	22 J	22 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	22 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	33 J	33 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	33 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	110 J	110 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	110 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	37 J	37 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	37 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	3.4 J	3.4 J	pg/g	TT-40: 6-8 ft BGS (11/3/2017)	1/1	--	3.4 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**3.6064**	**3.6064**	**pg/g**	**TT-40: 6-8 ft BGS (11/3/2017)**	**1/1**	**--**	**3.6064**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**3.60875**	**3.60875**	**pg/g**	**TT-40: 6-8 ft BGS (11/3/2017)**	**1/1**	**--**	**3.60875**	**4.8**	**C**	**Y**	**(6)**

Table 2.20

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU13 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos										
1332-21-4	Asbestos	ND	ND	%	--	0/6	1	N/A	--	N	ND
12001-29-5	Chrysotile asbestos	ND	ND	%	--	0/1	0.25	N/A	--	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH66-13, BH67-13, BH74-13, BH107-18, BH1108-18, BH109-18, BH110-18, BH159-17, SS-54, SS-55, SS-56, SS-57, SS-58, SS-59, SS-60, SS-61, SS-94, SS-168-AS, TT-40.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.21

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/7	1.1 - 270	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/5	17 - 270	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/7	1.5 - 270	N/A	150	N	N	ND
75-34-3	**1,1-Dichloroethane**	**2.6 J**	**110 J**	**µg/kg**	**SS-49: 0-2 ft BGS (10/29/2018)**	**3/7**	**0.91 - 270**	**110 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/7	1.2 - 270	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/5	160 - 350	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/5	110 - 540	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/7	1 - 270	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/5	26 - 270	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	4.3 J	4.3 J	µg/kg	SS-50: 0.17-2.17 ft BGS (10/29/2018)	1/7	1 - 270	4.3 J	460	C	N	BSV
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/7	1.1 - 270	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/5	26 - 270	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/5	21 - 270	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	18 J	540 J	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	3/8	4.7 - 1100	540 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/7	5.4 - 1100	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/7	4.9 - 1100	N/A	3300000	N	N	ND
67-64-1	Acetone	510 J	510 J	µg/kg	SS-47: 0-2 ft BGS (11/2/2018)	1/7	28 - 1100	510 J	6100000	N	N	BSV
71-43-2	Benzene	37 J	310 J	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	2/7	0.92 - 270	310 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/7	0.89 - 270	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/7	3.2 - 280	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/7	1.3 - 440	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/7	1.5 - 290	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/7	4.3 - 270	N/A	650	C	N	ND
108-90-7	Chlorobenzene	2100	2100	µg/kg	SS-47: 0-2 ft BGS (11/2/2018)	1/7	1.2 - 270	2100	28000	N	N	BSV
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/7	1.6 - 400	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/7	1 - 270	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/7	1.4 - 270	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	49	320	µg/kg	SS-47: 0-2 ft BGS (11/2/2018)	4/7	1.4 - 270	320	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/7	1.9 - 270	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/7	1.8 - 540	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/7	3.7 - 310	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/7	1.2 - 270	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	1200	2600	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	2/7	1.4 - 270	2600	5800	C	N	BSV
98-82-8	Isopropyl benzene	230 J	230 J	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	1/7	1.1 - 270	230 J	190000	N	N	BSV
79-20-9	Methyl acetate	150 J	150 J	µg/kg	BH68-13: 0.5-2.5 ft BGS (6/19/2013)	1/7	4.5 - 1400	150 J	7800000	N	N	BSV
108-87-2	Methyl cyclohexane	37 J	790 J	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	3/7	1.6 - 110	790 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/7	1.1 - 270	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/7	16 - 1000	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/7	1.5 - 270	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	1.7 J	67 J	µg/kg	SS-47: 0-2 ft BGS (11/2/2018)	2/8	0.96 - 270	67 J	8100	N	N	BSV
108-88-3	Toluene	24 J	4400	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	3/7	1 - 120	4400	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	2.2 J	24 J	µg/kg	SS-47: 0-2 ft BGS (11/2/2018)	3/7	0.61 - 270	24 J	160000	N	N	BSV

Table 2.21

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/7	1.4 - 280	N/A	1800	C	N	ND
79-01-6	**Trichloroethene**	**3.4 J**	**6400**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**8/8**	**--**	**6400**	**410**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/7	1.4 - 270	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/7	1.7 - 270	N/A	670000	N	N	ND
75-01-4	**Vinyl chloride**	**1.6 J**	**410 J**	**µg/kg**	**SS-49: 0-2 ft BGS (10/29/2018)**	**3/7**	**1.1 - 270**	**410 J**	**59**	**C**	**Y**	**ASV**
1330-20-7	Xylenes (total)	97 J	9400	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	4/7	2.1 - 38	9400	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/7	13 - 67	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/7	87 - 470	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/7	80 - 430	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/7	55 - 300	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/7	50 - 270	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/7	180 - 960	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/7	78 - 420	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/7	70 - 380	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/7	18 - 94	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/7	13 - 67	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	52	720	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	7/7	--	720	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/7	39 - 210	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/7	50 - 270	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/7	16 - 88	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	210 J	210 J	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	1/7	36 - 200	210 J	320000 (5)	N	N	BSV
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/7	54 - 290	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/7	62 - 330	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/7	100 - 540	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/7	18 - 94	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/7	57 - 300	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/7	38 - 200	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/7	18 - 94	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/7	75 - 400	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/7	120 - 630	N/A	--		N	ND
83-32-9	Acenaphthene	22 J	72	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	5/7	16 - 19	72	360000	N	N	BSV
208-96-8	Acenaphthylene	14 J	310	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	6/7	27	310	360000 (5)	N	N	BSV
98-86-2	Acetophenone	38 J	48 J	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	2/7	17 - 74	48 J	780000	N	N	BSV
120-12-7	Anthracene	36	250	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	6/7	16	250	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/7	45 - 240	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	140	140	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	1/7	35 - 160	140	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**59**	**1700**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**1700**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**39**	**2000**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**2000**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**61**	**3000**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**3000**	**1100**	**C**	**Y**	**ASV**

Table 2.21

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	46	1900	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	1900	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	160	1200	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	5/7	11 - 47	1200	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	29 J	97	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	2/7	41 - 110	97	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/7	15 - 81	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/7	15 - 81	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	130	1900	µg/kg	SS-50: 0.17-2.17 ft BGS (10/29/2018)	4/7	78 - 340	1900	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	250 J	250 J	µg/kg	SS-50: 0.17-2.17 ft BGS (10/29/2018)	1/7	28 - 150	250 J	290000	C	N	BSV
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/7	94 - 510	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**60 J**	**120**	**µg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**4/7**	**29 - 130**	**120**	**--**		**Y**	**AD**
218-01-9	Chrysene	94	2000	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	2000	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**91**	**510**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**4/7**	**11 - 47**	**510**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	49 J	120	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	5/7	72 - 88	120	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/7	39 - 210	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/7	18 - 94	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	71 J	71 J	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	1/7	34 - 150	71 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/7	35 - 190	N/A	63000	N	N	ND
206-44-0	Fluoranthene	110	2000	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	2000	240000	N	N	BSV
86-73-7	Fluorene	21	67	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	5/7	15 - 18	67	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/7	3.6 - 19	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/7	15 - 81	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/7	78 - 420	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/7	11 - 61	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**18 J**	**1700**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**1700**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/7	15 - 81	N/A	570000	C	N	ND
91-20-3	Naphthalene	64	620	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	6/7	16	620	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/7	16 - 88	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/7	14 - 74	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/7	15 - 81	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/7	73 - 390	N/A	1000	C	N	ND
85-01-8	Phenanthrene	130	1100	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	1100	180000 (5)	N	N	BSV
108-95-2	Phenol	37 J	87 J	µg/kg	SS-46: 0-2 ft BGS (10/30/2018)	3/7	12 - 44	87 J	1900000	N	N	BSV
129-00-0	Pyrene	110	2000	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	2000	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**4000**	**9200**	**mg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**9200**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**1.2**	**13**	**mg/kg**	**SS-53: 0-2 ft BGS (10/29/2018)**	**7/7**	**--**	**13**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**8.3**	**33**	**mg/kg**	**SS-53: 0-2 ft BGS (10/29/2018)**	**7/7**	**--**	**33**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**160**	**3100**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**3100**	**1500**	**N**	**Y**	**ASV**
7440-41-7	Beryllium	0.45	3.3	mg/kg	SS-49: 0-2 ft BGS (10/29/2018)	7/7	--	3.3	16	N	N	BSV
7440-43-9	**Cadmium**	**0.63**	**11**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**11**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	2200	110000	mg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	110000	--		N	NAT
16065-83-1	Chromium III (trivalent)	21	200	mg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	200	12000	N	N	BSV

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.55 J**	**1.2**	**mg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**4/7**	**0.28 - 1.3**	**1.2**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**5.1**	**17**	**mg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**17**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**62**	**2400**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**2400**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.56 J**	**13**	**mg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**4/7**	**0.21 - 0.29**	**13**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**16000**	**71000**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**71000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**22**	**4200**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**4200**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - coarse fraction**	**3600**	**47000**	**mg/kg**	**SS-50: 0.17-2.17 ft BGS (10/29/2018)**	**2/2**	**--**	**47000**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - fine fraction**	**3600**	**28000**	**mg/kg**	**SS-50: 0.17-2.17 ft BGS (10/29/2018)**	**2/2**	**--**	**28000**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - total (calculated by fine/coarse fraction)**	**3600**	**43000**	**mg/kg**	**SS-50: 0.17-2.17 ft BGS (10/29/2018)**	**2/2**	**--**	**43000**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	680	44000	mg/kg	SS-50: 0.17-2.17 ft BGS (10/29/2018)	7/7	--	44000	--		N	NAT
7439-96-5	**Manganese**	**230**	**880**	**mg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**880**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.19	0.62	mg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	0.62	1.1	N	N	BSV
7440-02-0	Nickel	17	110	mg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	110	150	N	N	BSV
7440-09-7	Potassium	360	1300	mg/kg	SS-49: 0-2 ft BGS (10/29/2018)	7/7	--	1300	--		N	NAT
7782-49-2	Selenium	0.73 J	5.6	mg/kg	SS-49: 0-2 ft BGS (10/29/2018)	7/7	--	5.6	39	N	N	BSV
7440-22-4	Silver	0.072 J	6.5	mg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	6.5	39	N	N	BSV
7440-23-5	Sodium	140 J	330	mg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	7/7	--	330	--		N	NAT
7440-28-0	**Thallium**	**0.11 J**	**0.49**	**mg/kg**	**SS-49: 0-2 ft BGS (10/29/2018)**	**7/7**	**--**	**0.49**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**13**	**46**	**mg/kg**	**SS-49: 0-2 ft BGS (10/29/2018)**	**7/7**	**--**	**46**	**39**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**58**	**3000**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**7/7**	**--**	**3000**	**2300**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/7	24 - 490	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/7	27 - 530	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/7	25 - 510	N/A	170	C	N	ND
53469-21-9	**Aroclor-1242 (PCB-1242)**	**370**	**370**	**µg/kg**	**SS-53: 0-2 ft BGS (10/29/2018)**	**1/7**	**21 - 420**	**370**	**230**	**C**	**Y**	**ASV**
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/7	27 - 530	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**54 J**	**620**	**µg/kg**	**SS-53: 0-2 ft BGS (10/29/2018)**	**5/7**	**35 - 510**	**620**	**120**	**C**	**Y**	**ASV**
11096-82-5	**Aroclor-1260 (PCB-1260)**	**250 J**	**14000**	**µg/kg**	**SS-50: 0.17-2.17 ft BGS (10/29/2018)**	**2/7**	**24 - 29**	**14000**	**240**	**C**	**Y**	**ASV**
	Pesticides											
72-54-8	4,4'-DDD	9.5 NJ	9.5 NJ	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	1/7	2 - 82	9.5 NJ	190	C	N	BSV
72-55-9	4,4'-DDE	9.4 NJ	53	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	3/7	2 - 83	53	2000	C	N	BSV
50-29-3	4,4'-DDT	51 J	74	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	3/7	1.5 - 62	74	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/7	1 - 42	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/7	1.2 - 50	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/7	2 - 83	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/7	2.3 - 95	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/7	2.2 - 93	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/7	1.5 - 61	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/7	1.6 - 66	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/7	2 - 82	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/7	1.7 - 71	N/A	38000	N	N	ND

Table 2.21

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/7	2.5 - 100	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/7	1.7 - 72	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/7	1.2 - 49	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/7	2.4 - 99	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/7	1.6 - 68	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/7	2.1 - 87	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/7	1.9 - 79	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/7	8.7 - 360	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/7	33 - 1400	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	16	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/1	17	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/1	61	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/2	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH68-13, SS-46, SS-47, SS-48, SS-49, SS-50, SS-51, SS-52, SS-53, SS-169-AS, SS-170-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.22

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/15	0.2 - 680	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/13	0.23 - 680	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/15	0.35 - 680	N/A	150	N	N	ND
75-34-3	**1,1-Dichloroethane**	**1.1 J**	**240 J**	**µg/kg**	**TT-9: 7 ft BGS (10/3/2008)**	**7/15**	**0.29 - 270**	**240 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	0.89 J	4.6 J	µg/kg	TT-8: 4 ft BGS (10/6/2008)	1/15	0.48 - 680	4.6 J	23000	N	N	BSV
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/13	0.21 - 680	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/13	0.6 - 1400	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/15	0.31 - 680	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/13	0.2 - 680	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	4.3 J	4.3 J	µg/kg	SS-50: 0.17-2.17 ft BGS (10/29/2018)	1/15	0.26 - 680	4.3 J	460	C	N	BSV
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/15	0.27 - 680	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/13	0.26 - 680	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	100 J	100 J	µg/kg	TT-9: 7 ft BGS (10/3/2008)	1/13	0.31 - 680	100 J	2600	C	N	BSV
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	2.8 J	540 J	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	7/16	1.1 - 1100	540 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/15	0.51 - 2700	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	860 J	1000 J	µg/kg	TT-9: 7 ft BGS (10/3/2008)	2/15	0.79 - 1100	1000 J	3300000	N	N	BSV
67-64-1	Acetone	14 J	510 J	µg/kg	SS-47: 0-2 ft BGS (11/2/2018)	3/15	2.7 - 2700	510 J	6100000	N	N	BSV
71-43-2	Benzene	0.43 J	310 J	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	6/15	0.31 - 270	310 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/15	0.29 - 680	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/15	0.35 - 680	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/15	0.52 - 680	N/A	680	N	N	ND
75-15-0	Carbon disulfide	0.83 J	110 J	µg/kg	TT-9: 17 ft BGS (10/3/2008)	2/15	0.19 - 580	110 J	77000	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/15	0.22 - 680	N/A	650	C	N	ND
108-90-7	Chlorobenzene	2000	4000	µg/kg	TT-9: 7 ft BGS (10/3/2008)	3/15	0.29 - 270	4000	28000	N	N	BSV
75-00-3	Chloroethane	4.3 J	4.3 J	µg/kg	TT-8: 4 ft BGS (10/6/2008)	1/15	0.34 - 680	4.3 J	1400000	N	N	BSV
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/15	0.2 - 680	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/15	0.34 - 680	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.63 J	890	µg/kg	TT-9: 7 ft BGS (10/3/2008)	9/15	0.25 - 270	890	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/15	0.23 - 680	N/A	1800	C	N	ND
110-82-7	Cyclohexane	0.74 J	160 J	µg/kg	TT-9: 17 ft BGS (10/3/2008)	2/15	0.19 - 1200	160 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/15	0.27 - 680	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/15	0.31 - 680	N/A	8700	N	N	ND
100-41-4	**Ethylbenzene**	**0.35 J**	**15000**	**µg/kg**	**TT-9: 7 ft BGS (10/3/2008)**	**6/15**	**0.36 - 270**	**15000**	**5800**	**C**	**Y**	**ASV**
98-82-8	Isopropyl benzene	110 J	2500	µg/kg	TT-9: 17 ft BGS (10/3/2008)	3/15	0.18 - 270	2500	190000	N	N	BSV
79-20-9	Methyl acetate	150 J	1300 J	µg/kg	TT-9: 17 ft BGS (10/3/2008)	3/15	1 - 1400	1300 J	7800000	N	N	BSV
108-87-2	Methyl cyclohexane	0.29 J	1100 J	µg/kg	TT-9: 17 ft BGS (10/3/2008)	8/15	0.2 - 110	1100 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	0.62 J	0.62 J	µg/kg	TT-8: 4 ft BGS (10/6/2008)	1/15	0.24 - 2700	0.62 J	47000	C	N	BSV
75-09-2	Methylene chloride	260 J	260 J	µg/kg	TT-9: 7 ft BGS (10/3/2008)	1/15	0.57 - 1000	260 J	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/15	0.24 - 680	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	0.34 J	67 J	µg/kg	SS-47: 0-2 ft BGS (11/2/2018)	3/16	0.35 - 680	67 J	8100	N	N	BSV
108-88-3	Toluene	0.65 J	5300	µg/kg	TT-9: 7 ft BGS (10/3/2008)	8/15	0.45 - 120	5300	490000	N	N	BSV

Table 2.22

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
156-60-5	trans-1,2-Dichloroethene	2.2 J	24 J	µg/kg	SS-47: 0-2 ft BGS (11/2/2018)	3/15	0.34 - 680	24 J	160000	N	N	BSV
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/15	0.19 - 680	N/A	1800	C	N	ND
79-01-6	**Trichloroethene**	**2.7 J**	**6400**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**14/16**	**4.7 - 36**	**6400**	**410**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/15	0.21 - 680	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/15	0.43 - 680	N/A	670000	N	N	ND
75-01-4	**Vinyl chloride**	**1.6 J**	**410 J**	**µg/kg**	**SS-49: 0-2 ft BGS (10/29/2018)**	**6/15**	**0.25 - 270**	**410 J**	**59**	**C**	**Y**	**ASV**
1330-20-7	Xylenes (total)	0.71 J	27000	µg/kg	TT-9: 7 ft BGS (10/3/2008)	10/15	0.53 - 38	27000	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/13	13 - 1300	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/13	40 - 1900	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/13	14 - 1900	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/13	32 - 1900	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/13	32 - 1900	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/13	33 - 4200	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/13	27 - 2600	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/13	33 - 2600	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/13	0.71 - 640	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/13	13 - 640	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	52	720	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	9/13	5.4 - 30	720	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/13	17 - 2600	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/13	14 - 2600	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/13	13 - 640	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	210 J	210 J	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	1/9	32 - 220	210 J	320000 (5)	N	N	BSV
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/13	29 - 1300	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/13	25 - 2600	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/4	210 - 2600	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/13	15 - 1900	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/13	18 - 640	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/13	33 - 1900	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/13	27 - 1900	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/13	18 - 640	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/13	41 - 2600	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/13	27 - 4200	N/A	--		N	ND
83-32-9	Acenaphthene	14	72	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	6/13	6.9 - 85	72	360000	N	N	BSV
208-96-8	Acenaphthylene	14 J	310	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	7/13	3.8 - 85	310	360000 (5)	N	N	BSV
98-86-2	Acetophenone	38 J	48 J	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	2/13	15 - 1300	48 J	780000	N	N	BSV
120-12-7	Anthracene	36	250	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	7/13	6.9 - 85	250	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/13	14 - 2600	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	140	140	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	1/13	19 - 1300	140	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**59**	**1700**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**9/13**	**6.9 - 85**	**1700**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**39**	**2000**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**9/13**	**6.9 - 85**	**2000**	**110**	**C**	**Y**	**ASV**

Table 2.22

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
205-99-2	**Benzo(b)fluoranthene**	**61**	**3000**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**9/13**	**6.4 - 85**	**3000**	**1100**	**C**	**Y**	**ASV**
191-24-2	Benzo(g,h,i)perylene	46	1900	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	9/13	3.8 - 85	1900	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	88	1200	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	7/13	6.9 - 85	1200	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	14 J	97	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	3/13	38 - 640	97	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/13	15 - 1300	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/13	3.2 - 1300	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	74 J	1900	µg/kg	SS-50: 0.17-2.17 ft BGS (10/29/2018)	7/13	52 - 340	1900	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	200	250 J	µg/kg	SS-50: 0.17-2.17 ft BGS (10/29/2018)	2/13	16 - 640	250 J	290000	C	N	BSV
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/13	59 - 4200	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**60 J**	**120**	**µg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**4/13**	**29 - 640**	**120**	**--**		**Y**	**AD**
218-01-9	Chrysene	94	2000	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	9/13	6.9 - 85	2000	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**37**	**510**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**5/13**	**6.9 - 85**	**510**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	32 J	120	µg/kg	SS-49: 0-2 ft BGS (10/29/2018)	6/13	7.2 - 640	120	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/13	25 - 640	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/13	18 - 640	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	45 J	71 J	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	2/13	24 - 640	71 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/13	13 - 640	N/A	63000	N	N	ND
206-44-0	Fluoranthene	110	2000	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	9/13	6 - 85	2000	240000	N	N	BSV
86-73-7	Fluorene	17	67	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	6/13	5.8 - 85	67	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/13	3.3 - 85	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/13	8.9 - 640	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/13	13 - 4200	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/13	11 - 640	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**18 J**	**1700**	**µg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**9/13**	**3.8 - 85**	**1700**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/13	15 - 640	N/A	570000	C	N	ND
91-20-3	Naphthalene	28	810	µg/kg	TT-9: 7 ft BGS (10/3/2008)	9/13	6.9 - 30	810	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/13	3.5 - 1300	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/13	10 - 640	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/13	15 - 640	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/13	14 - 1900	N/A	1000	C	N	ND
85-01-8	Phenanthrene	45 J	1100	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	10/13	6.9 - 85	1100	180000 (5)	N	N	BSV
108-95-2	Phenol	37 J	87 J	µg/kg	SS-46: 0-2 ft BGS (10/30/2018)	3/13	12 - 640	87 J	1900000	N	N	BSV
129-00-0	Pyrene	110	2000	µg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	9/13	4.8 - 85	2000	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**2100**	**9200**	**mg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**13/13**	**--**	**9200**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**1.2**	**13**	**mg/kg**	**SS-53: 0-2 ft BGS (10/29/2018)**	**12/13**	**6.2**	**13**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**1.5**	**35**	**mg/kg**	**TT-9: 7 ft BGS (10/3/2008)**	**13/13**	**--**	**35**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**10.1 J**	**3100**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**13/13**	**--**	**3100**	**1500**	**N**	**Y**	**ASV**
7440-41-7	Beryllium	0.19	3.3	mg/kg	SS-49: 0-2 ft BGS (10/29/2018)	12/13	0.52	3.3	16	N	N	BSV
7440-43-9	**Cadmium**	**0.15 J**	**13**	**mg/kg**	**BH105-18: 8.5-10.5 ft BGS (1/17/2018)**	**13/13**	**--**	**13**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	1670 J	140000	mg/kg	BH106-18: 13-15 ft BGS (1/17/2018)	13/13	--	140000	--		N	NAT

Table 2.22

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
16065-83-1	Chromium III (trivalent)	4.5	200	mg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	13/13	--	200	12000	N	N	BSV
18540-29-9	**Chromium VI (hexavalent)**	**0.55 J**	**8.6**	**mg/kg**	**TT-8: 4 ft BGS (10/6/2008)**	**9/13**	**0.28 - 1.9**	**8.6**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**2.3 J**	**17**	**mg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**13/13**	**--**	**17**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**7.2**	**2400**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**13/13**	**--**	**2400**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.27 J**	**13**	**mg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**7/13**	**0.055 - 0.64**	**13**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**5820**	**71000**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**13/13**	**--**	**71000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**4.6 J**	**4200**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**13/13**	**--**	**4200**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - coarse fraction**	**3600**	**47000**	**mg/kg**	**SS-50: 0.17-2.17 ft BGS (10/29/2018)**	**2/2**	**--**	**47000**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - fine fraction**	**3600**	**28000**	**mg/kg**	**SS-50: 0.17-2.17 ft BGS (10/29/2018)**	**2/2**	**--**	**28000**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - total (calculated by fine/coarse fraction)**	**3600**	**43000**	**mg/kg**	**SS-50: 0.17-2.17 ft BGS (10/29/2018)**	**2/2**	**--**	**43000**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	652 J	63000	mg/kg	BH106-18: 13-15 ft BGS (1/17/2018)	13/13	--	63000	--		N	NAT
7439-96-5	**Manganese**	**88.1**	**880**	**mg/kg**	**SS-51: 0.25-2.25 ft BGS (10/29/2018)**	**13/13**	**--**	**880**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.12 J	0.62	mg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	11/13	0.022 - 0.1	0.62	1.1	N	N	BSV
7440-02-0	Nickel	6.8 J	110	mg/kg	SS-48: 0.25-2.25 ft BGS (10/29/2018)	13/13	--	110	150	N	N	BSV
7440-09-7	Potassium	313 J	1300	mg/kg	SS-49: 0-2 ft BGS (10/29/2018)	13/13	--	1300	--		N	NAT
7782-49-2	Selenium	0.32 J	7.2 J	mg/kg	TT-9: 7 ft BGS (10/3/2008)	12/13	25.9 - 28.4	7.2 J	39	N	N	BSV
7440-22-4	Silver	0.072 J	6.5	mg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	9/13	0.02 - 1.9	6.5	39	N	N	BSV
7440-23-5	Sodium	106 J	596	mg/kg	TT-8: 4 ft BGS (10/6/2008)	12/13	160	596	--		N	NAT
7440-28-0	**Thallium**	**0.11 J**	**0.98**	**mg/kg**	**TT-9: 17 ft BGS (10/3/2008)**	**11/13**	**0.1 - 0.64**	**0.98**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**8.4**	**46**	**mg/kg**	**SS-49: 0-2 ft BGS (10/29/2018)**	**13/13**	**--**	**46**	**39**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**23.2**	**3000**	**mg/kg**	**SS-48: 0.25-2.25 ft BGS (10/29/2018)**	**13/13**	**--**	**3000**	**2300**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/13	24 - 490	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/13	26 - 530	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/13	25 - 510	N/A	170	C	N	ND
53469-21-9	**Aroclor-1242 (PCB-1242)**	**370**	**370**	**µg/kg**	**SS-53: 0-2 ft BGS (10/29/2018)**	**1/13**	**20 - 420**	**370**	**230**	**C**	**Y**	**ASV**
12672-29-6	**Aroclor-1248 (PCB-1248)**	**430**	**430**	**µg/kg**	**TT-8: 4 ft BGS (10/6/2008)**	**1/13**	**26 - 530**	**430**	**230**	**C**	**Y**	**ASV**
11097-69-1	**Aroclor-1254 (PCB-1254)**	**54 J**	**3700**	**µg/kg**	**TT-9: 7 ft BGS (10/3/2008)**	**7/13**	**25 - 510**	**3700**	**120**	**C**	**Y**	**ASV**
11096-82-5	**Aroclor-1260 (PCB-1260)**	**250 J**	**14000**	**µg/kg**	**SS-50: 0.17-2.17 ft BGS (10/29/2018)**	**3/13**	**24 - 420**	**14000**	**240**	**C**	**Y**	**ASV**
	Pesticides											
72-54-8	4,4'-DDD	9.5 NJ	9.5 NJ	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	1/13	2 - 200	9.5 NJ	190	C	N	BSV
72-55-9	4,4'-DDE	9.4 NJ	220	µg/kg	TT-9: 7 ft BGS (10/3/2008)	5/13	1.3 - 200	220	2000	C	N	BSV
50-29-3	4,4'-DDT	21 J	74	µg/kg	SS-51: 0.25-2.25 ft BGS (10/29/2018)	4/13	1.5 - 200	74	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/13	1 - 200	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/13	1.2 - 200	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/13	2 - 200	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/13	2.3 - 200	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/13	2.1 - 200	N/A	300	C	N	ND
60-57-1	**Dieldrin**	**12 J**	**270 J**	**µg/kg**	**TT-9: 7 ft BGS (10/3/2008)**	**2/13**	**0.97 - 200**	**270 J**	**34**	**C**	**Y**	**ASV**
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/13	1.4 - 200	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/13	1.9 - 200	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/13	1.7 - 200	N/A	38000	N	N	ND

Table 2.22

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/13	1.5 - 200	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	28 J	28 J	µg/kg	TT-9: 7 ft BGS (10/3/2008)	1/13	1.7 - 200	28 J	1900	N	N	BSV
53494-70-5	Endrin ketone	19 J	28 J	µg/kg	TT-9: 7 ft BGS (10/3/2008)	2/13	1.2 - 200	28 J	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/13	2.4 - 200	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	2.6 NJ	180 J	µg/kg	TT-9: 7 ft BGS (10/3/2008)	3/13	1.6 - 200	180 J	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/13	0.84 - 200	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	27 J	27 J	µg/kg	TT-9: 7 ft BGS (10/3/2008)	1/13	1.9 - 200	27 J	70	C	N	BSV
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/13	1.3 - 380	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/13	33 - 7800	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	16	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/5	17 - 38	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/5	61 - 150	N/A	70000	N	N	ND
	Dioxins/Furans											
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	25	25	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	25	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	380	380	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	380	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	48	48	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	48	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	52	52	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	52	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	3.0 J	3.0 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	3.0 J	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	11 J	11 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	11 J	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	1.7 J	1.7 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	1.7 J	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	7.9 J	7.9 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	7.9 J	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	6.9 J	6.9 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	6.9 J	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/1	1.1	N/A	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	5.6 J	5.6 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	5.6 J	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	2.8 J	2.8 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	2.8 J	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	2.1 J	2.1 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	2.1 J	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	6.0 J	6.0 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	6.0 J	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	5.1 J	5.1 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	5.1 J	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	17	17	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	17	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	ND	ND	pg/g	--	0/1	0.96	N/A	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	82 J	82 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	82 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	98 J	98 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	98 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	110 J	110 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	110 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	59 J	59 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	59 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	180 J	180 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	180 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	24 J	24 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	24 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	270 J	270 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	270 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	24 J	24 J	pg/g	BH105-18: 8.5-10.5 ft BGS (1/17/2018)	1/1	--	24 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**10.5855**	**10.5855**	**pg/g**	**BH105-18: 8.5-10.5 ft BGS (1/17/2018)**	**1/1**	**--**	**10.5855**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**11.0655**	**11.0655**	**pg/g**	**BH105-18: 8.5-10.5 ft BGS (1/17/2018)**	**1/1**	**--**	**11.0655**	**4.8**	**C**	**Y**	**(6)**

Table 2.22

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU14 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos										
1332-21-4	Asbestos	ND	ND	%	--	0/5	0.25 - 1	N/A	--	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH68-13, SS-46, SS-47, SS-48, SS-49, SS-50, SS-51, SS-52, SS-53, SS-169-AS, SS-170-AS, BH105-18, BH106-18, GP30-18, GP31-18, TT-8, TT-9.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.23

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/10	0.8 - 350	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/8	1.4 - 350	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/10	1.1 - 350	N/A	150	N	N	ND
75-34-3	**1,1-Dichloroethane**	**5.3 J**	**5.3 J**	**µg/kg**	**SS-134: 0.92-2.92 ft BGS (10/29/2018)**	**1/11**	**0.68 - 350**	**5.3 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/10	0.88 - 350	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/8	0.56 - 350	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/8	3.5 - 700	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/10	0.75 - 350	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/8	1.1 - 350	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/10	0.75 - 350	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/10	0.83 - 350	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	2.1 J	2.1 J	µg/kg	SS-134: 0.92-2.92 ft BGS (10/29/2018)	1/9	0.8 - 350	2.1 J	180000 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/8	0.86 - 350	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	8.3 J	85 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	7/12	18 - 1400	85 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/10	4 - 1400	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/10	3.6 - 1400	N/A	3300000	N	N	ND
67-64-1	Acetone	ND	ND	µg/kg	--	0/10	18 - 1400	N/A	6100000	N	N	ND
71-43-2	Benzene	1.3 J	21 J	µg/kg	SS-134: 0.92-2.92 ft BGS (10/29/2018)	3/11	0.68 - 350	21 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/10	0.66 - 350	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/10	2.3 - 350	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/10	0.96 - 350	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/10	1.1 - 350	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/10	3.2 - 350	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/10	0.89 - 350	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/10	1.2 - 350	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/10	0.77 - 350	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/10	1 - 350	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	270 J	690	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	2/10	0.64 - 350	690	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/10	1.4 - 350	N/A	1800	C	N	ND
110-82-7	Cyclohexane	46 J	46 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	1/10	1.3 - 700	46 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/10	2.7 - 350	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/10	0.92 - 350	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/10	1 - 350	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	85 J	85 J	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	1/10	0.81 - 350	85 J	190000	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/10	3.3 - 900	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	75 J	160 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	2/10	1.2 - 110	160 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/10	0.8 - 350	N/A	47000	C	N	ND
75-09-2	Methylene chloride	280 J	470 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	1/10	6.4 - 650	470 J	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/10	1.1 - 350	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	1.2 J	99 J	µg/kg	SS-135: 0.25-2.25 ft BGS (10/29/2018)	6/11	0.71 - 52	99 J	8100	N	N	BSV
108-88-3	Toluene	1.5 J	110 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	3/10	0.75 - 110	110 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	56 J	56 J	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	1/10	0.45 - 350	56 J	160000	N	N	BSV

Table 2.23

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/10	1 - 350	N/A	1800	C	N	ND
79-01-6	**Trichloroethene**	**1.5 J**	**4300**	**µg/kg**	**BH51-13: 0-2 ft BGS (6/21/2013)**	**9/11**	**0.62 - 0.63**	**4300**	**410**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/10	1.1 - 350	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/10	1.3 - 350	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	54 J	54 J	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	1/10	0.82 - 350	54 J	59	C	N	BSV
1330-20-7	Xylenes (total)	140 J	230 J	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	3/10	1.5 - 69	230 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/10	10 - 200	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/10	71 - 1100	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/10	64 - 990	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/10	46 - 680	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/10	41 - 620	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/10	150 - 2200	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/10	64 - 960	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/10	58 - 870	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/10	3.2 - 220	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/10	10 - 170	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	6.7 J	730	µg/kg	SS-133: 0.5-2.5 ft BGS (10/29/2018)	9/10	2.7	730	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/10	32 - 480	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/10	41 - 620	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/10	13 - 200	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/10	30 - 450	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/10	45 - 670	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/10	51 - 760	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/10	66 - 1200	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/10	15 - 270	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/10	47 - 700	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/10	31 - 470	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/10	15 - 270	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/10	62 - 930	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/10	97 - 1500	N/A	--		N	ND
83-32-9	Acenaphthene	4.9 J	1400 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	5/10	3 - 44	1400 J	360000	N	N	BSV
208-96-8	Acenaphthylene	5.7 J	97 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	7/10	4.2 - 62	97 J	360000 (5)	N	N	BSV
98-86-2	Acetophenone	110 J	110 J	µg/kg	SS-137: 0.17-2.17 ft BGS (10/29/2018)	1/10	11 - 190	110 J	780000	N	N	BSV
120-12-7	Anthracene	4.8 J	3600 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	8/10	3.3 - 37	3600 J	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/10	37 - 560	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/kg	--	0/10	24 - 360	N/A	170000	N	N	ND
56-55-3	**Benzo(a)anthracene**	**34**	**9600**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**9/10**	**4.6**	**9600**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**34**	**8500**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**9/10**	**13**	**8500**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**57**	**12000**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**9/10**	**8.8**	**12000**	**1100**	**C**	**Y**	**ASV**

Table 2.23

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	46	6100	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	9/10	9.6	6100	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	17	4200	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	9/10	9.4	4200	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	49 J	86 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	2/10	18 - 260	86 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/10	12 - 460	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/10	12 - 190	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	110 J	17000	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	4/10	53 - 400	17000	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/10	23 - 340	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/10	78 - 1200	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**25 J**	**1500**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**4/10**	**20 - 290**	**1500**	**--**		**Y**	**AD**
218-01-9	Chrysene	44	9300	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	9/10	2	9300	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**18**	**1600**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**6/10**	**7.3 - 110**	**1600**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	14 J	780 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	7/10	14 - 200	780 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	350 J	380	µg/kg	SS-131: 0-2 ft BGS (10/29/2018)	2/10	32 - 480	380	5100000	N	N	BSV
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/10	15 - 360	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	27 J	360 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	3/10	23 - 340	360 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/10	29 - 430	N/A	63000	N	N	ND
206-44-0	Fluoranthene	51	21000	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	9/10	6	21000	240000	N	N	BSV
86-73-7	Fluorene	4.8 J	1300 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	6/10	2.9 - 43	1300 J	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/10	3 - 44	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/10	12 - 190	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/10	58 - 960	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/10	9.3 - 190	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**29**	**5300**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**9/10**	**10**	**5300**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/10	12 - 270	N/A	570000	C	N	ND
91-20-3	Naphthalene	9.2 J	400	µg/kg	SS-133: 0.5-2.5 ft BGS (10/29/2018)	9/10	3.3	400	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/10	13 - 200	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/10	11 - 170	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/10	12 - 440	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/10	60 - 900	N/A	1000	C	N	ND
85-01-8	Phenanthrene	35	13000	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	9/10	3	13000	180000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/10	8.3 - 150	N/A	1900000	N	N	ND
129-00-0	Pyrene	39	18000	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	9/10	2.9	18000	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**2800**	**13000**	**mg/kg**	**SS-130: 0.25-2.25 ft BGS (10/29/2018)**	**10/10**	**--**	**13000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.24 J**	**12**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**10/10**	**--**	**12**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**4.7**	**27**	**mg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**10/10**	**--**	**27**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**54**	**2900**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**10/10**	**--**	**2900**	**1500**	**N**	**Y**	**ASV**
7440-41-7	Beryllium	0.28	3.9	mg/kg	SS-134: 0.92-2.92 ft BGS (10/29/2018)	10/10	--	3.9	16	N	N	BSV
7440-43-9	**Cadmium**	**0.2**	**16**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**10/10**	**--**	**16**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	1500	130000	mg/kg	SS-131: 0-2 ft BGS (10/29/2018)	10/10	--	130000	--		N	NAT
16065-83-1	Chromium III (trivalent)	9	210	mg/kg	SS-136: 0-2 ft BGS (10/29/2018)	10/10	--	210	12000	N	N	BSV

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Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.74 J**	**6.9**	**mg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**6/10**	**0.25 - 1.5**	**6.9**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**3.2**	**29**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**10/10**	**--**	**29**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**17**	**2900**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**10/10**	**--**	**2900**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.62**	**41**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**3/10**	**0.2 - 2.8**	**41**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**8800**	**110000**	**mg/kg**	**SS-137: 0.17-2.17 ft BGS (10/29/2018)**	**10/10**	**--**	**110000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**15**	**2600 J**	**mg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**10/10**	**--**	**2600 J**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - coarse fraction**	**18**	**2000**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**3/3**	**--**	**2000**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - fine fraction**	**26**	**2700**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**3/3**	**--**	**2700**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - total (calculated by fine/coarse fraction)**	**19**	**2200**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**3/3**	**--**	**2200**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	380	54000	mg/kg	SS-131: 0-2 ft BGS (10/29/2018)	10/10	--	54000	--		N	NAT
7439-96-5	**Manganese**	**34**	**1100**	**mg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**10/10**	**--**	**1100**	**180**	**N**	**Y**	**ASV**
7439-97-6	**Mercury**	**0.021 J**	**6.1**	**mg/kg**	**SS-130: 0.25-2.25 ft BGS (10/29/2018)**	**9/10**	**0.019**	**6.1**	**1.1**	**N**	**Y**	**ASV**
7440-02-0	Nickel	9.1	150	mg/kg	SS-136: 0-2 ft BGS (10/29/2018)	10/10	--	150	150	N	N	BSV
7440-09-7	Potassium	400	1300	mg/kg	SS-137: 0.17-2.17 ft BGS (10/29/2018)	10/10	--	1300	--		N	NAT
7782-49-2	Selenium	0.37 J	4.4	mg/kg	SS-134: 0.92-2.92 ft BGS (10/29/2018)	10/10	--	4.4	39	N	N	BSV
7440-22-4	Silver	0.043 J	8.2	mg/kg	SS-141: 0-2 ft BGS (10/29/2018)	10/10	--	8.2	39	N	N	BSV
7440-23-5	Sodium	64 J	560	mg/kg	SS-136: 0-2 ft BGS (10/29/2018)	10/10	--	560	--		N	NAT
7440-28-0	**Thallium**	**0.075 J**	**0.65**	**mg/kg**	**SS-134: 0.92-2.92 ft BGS (10/29/2018)**	**10/10**	**--**	**0.65**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**10**	**50**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**10/10**	**--**	**50**	**39**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**45**	**5600**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**10/10**	**--**	**5600**	**2300**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/10	22 - 240	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/10	24 - 260	N/A	200	C	N	ND
11141-16-5	**Aroclor-1232 (PCB-1232)**	**1100**	**1100**	**µg/kg**	**SS-141: 0-2 ft BGS (10/29/2018)**	**1/10**	**17 - 140**	**1100**	**170**	**C**	**Y**	**ASV**
53469-21-9	**Aroclor-1242 (PCB-1242)**	**1100**	**1100**	**µg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**1/10**	**19 - 200**	**1100**	**230**	**C**	**Y**	**ASV**
12672-29-6	**Aroclor-1248 (PCB-1248)**	**1300 J**	**1900 J**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**1/10**	**24 - 260**	**1900 J**	**230**	**C**	**Y**	**ASV**
11097-69-1	**Aroclor-1254 (PCB-1254)**	**86**	**1800**	**µg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**4/10**	**15 - 32**	**1800**	**120**	**C**	**Y**	**ASV**
11096-82-5	**Aroclor-1260 (PCB-1260)**	**44 J**	**1100 J**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**3/10**	**22 - 240**	**1100 J**	**240**	**C**	**Y**	**ASV**
	Pesticides											
72-54-8	4,4'-DDD	2.0 NJ	2.0 NJ	µg/kg	SS-130: 0.25-2.25 ft BGS (10/29/2018)	1/10	1.6 - 97	2.0 NJ	190	C	N	BSV
72-55-9	4,4'-DDE	2.3 J	20 NJ	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	2/10	1.6 - 99	20 NJ	2000	C	N	BSV
50-29-3	4,4'-DDT	6.2 J	6.2 J	µg/kg	SS-130: 0.25-2.25 ft BGS (10/29/2018)	1/10	1.2 - 74	6.2 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/10	0.81 - 51	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/10	0.95 - 60	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/10	1.6 - 99	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/10	1.8 - 110	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/10	1.8 - 110	N/A	300	C	N	ND
60-57-1	Dieldrin	14 NJ	14 NJ	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	1/10	1.2 - 72	14 NJ	34	C	N	BSV
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/10	1.3 - 79	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/10	1.6 - 97	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/10	1.3 - 84	N/A	38000	N	N	ND

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Medium: EU15 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	17 NJ	17 NJ	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	1/10	2 - 120	17 NJ	1900	N	N	BSV
7421-93-4	Endrin aldehyde	2.1 NJ	36 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	2/10	1.4 - 86	36 J	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/10	0.93 - 58	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/10	1.9 - 120	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/10	1.3 - 81	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/10	1.7 - 100	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	9.6 NJ	9.6 NJ	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	1/10	1.5 - 95	9.6 NJ	70	C	N	BSV
72-43-5	Methoxychlor	20 NJ	20 NJ	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	1/10	6.9 - 430	20 NJ	32000	N	N	BSV
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/10	26 - 1600	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	15	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/1	16	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/1	57	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**--**	**--**	**pg/g**	**--**	**--**	**--**	**--**	**4.8**	**C**	**Y**	**(6)**
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/2	0.25	N/A	--		N	ND
12001-29-5	Chrysotile asbestos	ND	ND	%	--	0/1	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH51-13, BH53-13, SS-125, SS-130, SS-131, SS-132, SS-133, SS-134, SS-135, SS-136, SS-137, SS-141, SS-143, SS-171-AS, SS-172-AS, SS-173-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.24

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/19	0.21 - 430	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/17	0.23 - 430	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/19	0.35 - 430	N/A	150	N	N	ND
75-34-3	**1,1-Dichloroethane**	**5.3 J**	**5.3 J**	**µg/kg**	**SS-134: 0.92-2.92 ft BGS (10/29/2018)**	**1/20**	**0.3 - 430**	**5.3 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/19	0.49 - 430	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/17	0.22 - 430	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/17	0.61 - 860	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/19	0.32 - 430	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/17	0.2 - 430	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/19	0.26 - 430	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/19	0.28 - 430	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	2.1 J	2.1 J	µg/kg	SS-134: 0.92-2.92 ft BGS (10/29/2018)	1/18	0.26 - 430	2.1 J	180000 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/17	0.32 - 430	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	2.9 J	85 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	10/21	1.2 - 1700	85 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/19	0.52 - 1700	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/19	0.8 - 1700	N/A	3300000	N	N	ND
67-64-1	Acetone	5.4 J	120 J	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	3/20	2.8 - 130000	120 J	6100000	N	N	BSV
71-43-2	Benzene	0.62 J	21 J	µg/kg	SS-134: 0.92-2.92 ft BGS (10/29/2018)	4/20	0.29 - 430	21 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/19	0.3 - 430	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/19	0.36 - 430	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/19	0.53 - 430	N/A	680	N	N	ND
75-15-0	Carbon disulfide	1.3 J	1.8 J	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	2/19	0.19 - 430	1.8 J	77000	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/19	0.23 - 430	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/19	0.3 - 430	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/19	0.34 - 430	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/19	0.21 - 430	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/19	0.34 - 430	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.36 J	1000	µg/kg	TT-43: 6-8 ft BGS (11/8/2017)	9/19	0.45 - 350	1000	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/19	0.23 - 430	N/A	1800	C	N	ND
110-82-7	Cyclohexane	46 J	46 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	1/19	0.19 - 860	46 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/19	0.27 - 430	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/19	0.32 - 430	N/A	8700	N	N	ND
100-41-4	**Ethylbenzene**	**260000 J**	**260000 J**	**µg/kg**	**BH55-13: 2-4 ft BGS (6/18/2013)**	**1/20**	**0.24 - 430**	**260000 J**	**5800**	**C**	**Y**	**ASV**
98-82-8	Isopropyl benzene	85 J	57000 J	µg/kg	BH55-13: 2-4 ft BGS (6/18/2013)	2/20	0.18 - 430	57000 J	190000	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/19	1.1 - 900	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	2.3 J	160 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	4/19	0.21 - 860	160 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/19	0.24 - 430	N/A	47000	C	N	ND
75-09-2	Methylene chloride	55	560	µg/kg	TT-43: 6-8 ft BGS (11/8/2017)	3/20	5 - 33000	560	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/19	0.24 - 430	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	1.2 J	99 J	µg/kg	SS-135: 0.25-2.25 ft BGS (10/29/2018)	6/20	0.33 - 430	99 J	8100	N	N	BSV
108-88-3	Toluene	0.59 J	95000 J	µg/kg	BH55-13: 2-4 ft BGS (6/18/2013)	9/20	0.31 - 110	95000 J	490000	N	N	BSV

Table 2.24

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
156-60-5	trans-1,2-Dichloroethene	56 J	56 J	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	1/19	0.34 - 430	56 J	160000	N	N	BSV
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/19	0.19 - 430	N/A	1800	C	N	ND
79-01-6	**Trichloroethene**	**0.64 J**	**5200**	**µg/kg**	**TT-43: 6-8 ft BGS (11/8/2017)**	**15/20**	**0.38 - 0.72**	**5200**	**410**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/19	0.22 - 430	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/19	0.44 - 430	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	1.9 J	54 J	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	2/19	0.25 - 430	54 J	59	C	N	BSV
1330-20-7	**Xylenes (total)**	**2.2 J**	**2000000 J**	**µg/kg**	**BH55-13: 2-4 ft BGS (6/18/2013)**	**6/20**	**0.36 - 860**	**2000000 J**	**58000**	**N**	**Y**	**ASV**
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/15	10 - 250	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/15	29 - 1100	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/15	10 - 990	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/15	23 - 680	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	490 J	1400 J	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	1/15	23 - 620	1400 J	130000	N	N	BSV
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/15	24 - 2200	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/15	20 - 960	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/15	24 - 870	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/15	0.52 - 220	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/15	9.6 - 220	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	6.7 J	730	µg/kg	SS-133: 0.5-2.5 ft BGS (10/29/2018)	12/15	0.58 - 9.9	730	240000	N	N	BSV
95-48-7	2-Methylphenol	88 J	330 J	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	1/15	13 - 480	330 J	320000	N	N	BSV
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/15	11 - 620	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/15	9.7 - 220	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	3900	23000	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	1/14	23 - 450	23000	320000 (5)	N	N	BSV
91-94-1	3,3'-Dichlorobenzidine	890 J	890 J	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	1/15	21 - 670	890 J	1200	c	N	BSV
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/15	19 - 760	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/1	300	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/15	11 - 1200	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/15	15 - 350	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/15	24 - 700	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/15	20 - 470	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/15	15 - 350	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/15	30 - 930	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/15	20 - 1500	N/A	--		N	ND
83-32-9	Acenaphthene	4.9 J	1400 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	7/15	0.89 - 44	1400 J	360000	N	N	BSV
208-96-8	Acenaphthylene	5.7 J	97 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	8/15	0.41 - 62	97 J	360000 (5)	N	N	BSV
98-86-2	Acetophenone	110 J	110 J	µg/kg	SS-137: 0.17-2.17 ft BGS (10/29/2018)	1/15	11 - 250	110 J	780000	N	N	BSV
120-12-7	Anthracene	4.4 J	3600 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	11/15	0.91 - 37	3600 J	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/15	11 - 560	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	92 J	92 J	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	1/15	14 - 360	92 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**11**	**9600**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**12/15**	**0.73 - 9.9**	**9600**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**15**	**8500**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**12/15**	**0.75 - 13**	**8500**	**110**	**C**	**Y**	**ASV**

Table 2.24

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
205-99-2	**Benzo(b)fluoranthene**	**21**	**12000**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**12/15**	**0.69 - 9.9**	**12000**	**1100**	**C**	**Y**	**ASV**
191-24-2	Benzo(g,h,i)perylene	14	6100	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	12/15	0.41 - 9.9	6100	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	8.2	4200	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	12/15	0.79 - 9.9	4200	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	34 J	160 J	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	4/15	4.1 - 260	160 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/15	12 - 590	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/15	2.3 - 190	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	28 J	17000	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	6/15	22 - 510	17000	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/15	12 - 340	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/15	43 - 1200	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**25 J**	**1500**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**5/15**	**20 - 720**	**1500**	**--**		**Y**	**AD**
218-01-9	Chrysene	16	9300	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	12/15	1.3 - 9.9	9300	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**18**	**1600**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**7/15**	**0.77 - 110**	**1600**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	14 J	780 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	9/15	0.77 - 200	780 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	350 J	1100 J	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	4/15	19 - 480	1100 J	5100000	N	N	BSV
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/15	15 - 450	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	27 J	2400	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	5/15	17 - 340	2400	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/15	9.2 - 430	N/A	63000	N	N	ND
206-44-0	Fluoranthene	33	21000	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	12/15	0.64 - 9.9	21000	240000	N	N	BSV
86-73-7	Fluorene	4.8 J	1300 J	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	9/15	0.62 - 43	1300 J	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/15	2.4 - 56	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/15	6.5 - 190	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/14	9.8 - 960	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/15	9.3 - 240	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**11**	**5300**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**12/15**	**0.41 - 10**	**5300**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/15	12 - 350	N/A	570000	C	N	ND
91-20-3	Naphthalene	9.2 J	1700	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	12/15	0.96 - 9.9	1700	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/15	2.6 - 200	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/15	7.3 - 170	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/15	12 - 560	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/15	11 - 900	N/A	1000	C	N	ND
85-01-8	Phenanthrene	35	13000	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	12/15	0.85 - 9.9	13000	180000 (5)	N	N	BSV
108-95-2	Phenol	220 J	1400	µg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	2/15	8.3 - 150	1400	1900000	N	N	BSV
129-00-0	Pyrene	26	18000	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	12/15	0.51 - 9.9	18000	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**2800**	**21700**	**mg/kg**	**TT-23: 7 ft BGS (10/6/2008)**	**15/15**	**--**	**21700**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.23 J**	**70.1 J**	**mg/kg**	**TT-23: 7 ft BGS (10/6/2008)**	**15/15**	**--**	**70.1 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**4.7**	**54**	**mg/kg**	**BH143-18: 10-12 ft BGS (1/23/2018)**	**15/15**	**--**	**54**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**54**	**3500**	**mg/kg**	**TT-23: 7 ft BGS (10/6/2008)**	**15/15**	**--**	**3500**	**1500**	**N**	**Y**	**ASV**
7440-41-7	Beryllium	0.28	5.8	mg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	15/15	--	5.8	16	N	N	BSV
7440-43-9	**Cadmium**	**0.2**	**16**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**15/15**	**--**	**16**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	1500	130000	mg/kg	SS-131: 0-2 ft BGS (10/29/2018)	15/15	--	130000	--		N	NAT

Table 2.24

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
16065-83-1	Chromium III (trivalent)	9	926	mg/kg	TT-23: 7 ft BGS (10/6/2008)	15/15	--	926	12000	N	N	BSV
18540-29-9	**Chromium VI (hexavalent)**	**0.38 J**	**154**	**mg/kg**	**TT-23: 7 ft BGS (10/6/2008)**	**10/15**	**0.25 - 1.5**	**154**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**3.2**	**317**	**mg/kg**	**TT-23: 7 ft BGS (10/6/2008)**	**15/15**	**--**	**317**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**17**	**2900**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**15/15**	**--**	**2900**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.40 J**	**41**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**4/15**	**0.12 - 2.8**	**41**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**8800**	**110000**	**mg/kg**	**SS-137: 0.17-2.17 ft BGS (10/29/2018)**	**15/15**	**--**	**110000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**15**	**17700**	**mg/kg**	**TT-23: 7 ft BGS (10/6/2008)**	**15/15**	**--**	**17700**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - coarse fraction**	**18**	**2000**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**3/3**	**--**	**2000**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - fine fraction**	**26**	**2700**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**3/3**	**--**	**2700**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - total (calculated by fine/coarse fraction)**	**19**	**2200**	**mg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**3/3**	**--**	**2200**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	380	54000	mg/kg	SS-131: 0-2 ft BGS (10/29/2018)	15/15	--	54000	--		N	NAT
7439-96-5	**Manganese**	**34**	**1100**	**mg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**15/15**	**--**	**1100**	**180**	**N**	**Y**	**ASV**
7439-97-6	**Mercury**	**0.021 J**	**6.1**	**mg/kg**	**SS-130: 0.25-2.25 ft BGS (10/29/2018)**	**13/15**	**0.019 - 0.024**	**6.1**	**1.1**	**N**	**Y**	**ASV**
7440-02-0	Nickel	9.1	150	mg/kg	SS-136: 0-2 ft BGS (10/29/2018)	15/15	--	150	150	N	N	BSV
7440-09-7	Potassium	400	1680	mg/kg	TT-23: 7 ft BGS (10/6/2008)	15/15	--	1680	--		N	NAT
7782-49-2	Selenium	0.37 J	21	mg/kg	BH143-18: 10-12 ft BGS (1/23/2018)	15/15	--	21	39	N	N	BSV
7440-22-4	Silver	0.036 J	8.2	mg/kg	SS-141: 0-2 ft BGS (10/29/2018)	15/15	--	8.2	39	N	N	BSV
7440-23-5	Sodium	64 J	2970	mg/kg	TT-23: 7 ft BGS (10/6/2008)	14/15	58	2970	--		N	NAT
7440-28-0	**Thallium**	**0.075 J**	**1.4**	**mg/kg**	**BH143-18: 10-12 ft BGS (1/23/2018)**	**14/15**	**3.7**	**1.4**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**10**	**73**	**mg/kg**	**BH143-18: 10-12 ft BGS (1/23/2018)**	**15/15**	**--**	**73**	**39**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**31**	**19600**	**mg/kg**	**TT-23: 7 ft BGS (10/6/2008)**	**15/15**	**--**	**19600**	**2300**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/15	22 - 310	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/15	24 - 340	N/A	200	C	N	ND
11141-16-5	**Aroclor-1232 (PCB-1232)**	**1100**	**1100**	**µg/kg**	**SS-141: 0-2 ft BGS (10/29/2018)**	**1/15**	**17 - 330**	**1100**	**170**	**C**	**Y**	**ASV**
53469-21-9	**Aroclor-1242 (PCB-1242)**	**230 J**	**1100**	**µg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**2/15**	**19 - 270**	**1100**	**230**	**C**	**Y**	**ASV**
12672-29-6	**Aroclor-1248 (PCB-1248)**	**1300 J**	**8600**	**µg/kg**	**TT-43: 6-8 ft BGS (11/8/2017)**	**2/15**	**24 - 340**	**8600**	**230**	**C**	**Y**	**ASV**
11097-69-1	**Aroclor-1254 (PCB-1254)**	**86**	**1800**	**µg/kg**	**SS-136: 0-2 ft BGS (10/29/2018)**	**5/15**	**15 - 330**	**1800**	**120**	**C**	**Y**	**ASV**
11096-82-5	**Aroclor-1260 (PCB-1260)**	**44 J**	**1100 J**	**µg/kg**	**SS-132: 0.7-2.7 ft BGS (11/8/2017)**	**4/15**	**22 - 310**	**1100 J**	**240**	**C**	**Y**	**ASV**
	Pesticides											
72-54-8	4,4'-DDD	2.0 NJ	2.0 NJ	µg/kg	SS-130: 0.25-2.25 ft BGS (10/29/2018)	1/15	1.6 - 97	2.0 NJ	190	C	N	BSV
72-55-9	4,4'-DDE	2.3 J	20 NJ	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	2/15	1.4 - 99	20 NJ	2000	C	N	BSV
50-29-3	4,4'-DDT	5.1 J	38 NJ	µg/kg	TT-43: 6-8 ft BGS (11/8/2017)	3/15	1.2 - 74	38 NJ	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/15	0.81 - 54	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/15	0.95 - 60	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/15	1.6 - 99	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/15	1.8 - 110	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/15	1.5 - 170	N/A	300	C	N	ND
60-57-1	Dieldrin	14 NJ	14 NJ	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	1/15	1.1 - 72	14 NJ	34	C	N	BSV
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/15	1.3 - 79	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/15	1.6 - 97	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/15	1.3 - 160	N/A	38000	N	N	ND

Table 2.24

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	17 NJ	17 NJ	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	1/15	1.6 - 120	17 NJ	1900	N	N	BSV
7421-93-4	Endrin aldehyde	2.1 NJ	54 J	µg/kg	TT-43: 6-8 ft BGS (11/8/2017)	3/15	1.4 - 240	54 J	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/15	0.93 - 58	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/15	1.9 - 120	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/15	1.3 - 81	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/15	0.91 - 100	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	9.6 NJ	9.6 NJ	µg/kg	SS-136: 0-2 ft BGS (10/29/2018)	1/15	1.5 - 95	9.6 NJ	70	C	N	BSV
72-43-5	Methoxychlor	20 NJ	20 NJ	µg/kg	SS-132: 0.7-2.7 ft BGS (11/8/2017)	1/15	1.4 - 430	20 NJ	32000	N	N	BSV
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/15	26 - 1600	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/1	15	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/2	16 - 30	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/2	57 - 120	N/A	70000	N	N	ND
	Dioxins/Furans											
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	1.3 J	330	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	4/4	0.39	330	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	4.9 J	1400	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	4/4	--	1400	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	1.0 J	410	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	4/4	--	410	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	5.2 J	300	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	3/4	0.23	300	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	17	17	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	1/4	0.099 - 0.3	17	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	1.5 J	130	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	2/4	0.074 - 0.24	130	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.43 J	9.3	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	2/4	0.019 - 0.27	9.3	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	0.51 J	59 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	3/4	0.069 - 0.22	59 J	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	2.7 J	35	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	2/4	0.021 - 0.28	35	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/4	0.088 - 3.8	N/A	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	3.3 J	30	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	2/4	0.019 - 0.26	30	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.71 J	24	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	2/4	0.16 - 0.22	24	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	1.0 J	10 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	2/4	0.17 - 0.46	10 J	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.5 J	47	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	2/4	0.074 - 0.22	47	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	1.8 J	55	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	2/4	0.13 - 0.18	55	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	28	28	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	1/4	0.29 - 0.37	28	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	5.7	5.7	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	1/4	0.34 - 0.62	5.7	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	1.4 J	880 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	4/4	--	880 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	10 J	600 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	3/4	0.23	600 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	1.3 J	830 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	4/4	--	830 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	1.6 J	360 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	3/4	0.28	360 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	2.4 J	1300 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	4/4	--	1300 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	5.0 J	2500 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	2/4	0.17 - 0.46	2500 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	3.5 J	1900 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	4/4	--	1900 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	0.79 J	160 J	pg/g	TT-43: 6-8 ft BGS (11/8/2017)	3/4	0.58 - 0.62	160 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**0.06686**	**74.539**	**pg/g**	**TT-43: 6-8 ft BGS (11/8/2017)**	**4/4**	**--**	**74.539**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**0.5216035**	**74.729**	**pg/g**	**TT-43: 6-8 ft BGS (11/8/2017)**	**4/4**	**--**	**74.729**	**4.8**	**C**	**Y**	**(6)**

Table 2.24

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU15 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos										
1332-21-4	Asbestos	ND	ND	%	--	0/5	0.25 - 1	N/A	--	N	ND
12001-29-5	Chrysotile asbestos	ND	ND	%	--	0/1	0.25	N/A	--	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH51-13, BH53-13, SS-125, SS-130, SS-131, SS-132, SS-133, SS-134, SS-135, SS-136, SS-137, SS-141, SS-143, SS-171-AS, SS-172-AS, SS-173-AS.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.25

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/2	4.9 - 29	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/2	4.9 - 25	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/2	4.9 - 24	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/2	4.9 - 32	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/2	4.9 - 37	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/2	4.9 - 27	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/2	9.8 - 50	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/2	4.9 - 24	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/2	4.9 - 19	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/2	4.9 - 31	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/2	4.9 - 31	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/2	4.9 - 39	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/2	4.9 - 28	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	5.1 J	5.1 J	µg/kg	BH36-13: 0-2 ft BGS (7/1/2013)	1/2	50 - 52	5.1 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/2	20 - 89	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.90 J	0.90 J	µg/kg	BH36-13: 0-2 ft BGS (7/1/2013)	1/2	40 - 41	0.90 J	3300000	N	N	BSV
67-64-1	Acetone	ND	ND	µg/kg	--	0/2	20 - 100	N/A	6100000	N	N	ND
71-43-2	Benzene	29 J	37 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/2	4.9	37 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/2	4.9 - 19	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/2	4.9 - 24	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/2	4.9 - 29	N/A	680	N	N	ND
75-15-0	Carbon disulfide	0.63 J	0.63 J	µg/kg	BH36-13: 0-2 ft BGS (7/1/2013)	1/2	18 - 19	0.63 J	77000	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/2	4.9 - 28	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/2	4.9 - 31	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/2	4.9 - 29	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/2	4.9 - 25	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/2	4.9 - 19	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	3300	4200	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/2	4.9	4200	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/2	4.9 - 24	N/A	1800	C	N	ND
110-82-7	Cyclohexane	34 J	43 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/2	9.8	43 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/2	4.9 - 35	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/2	4.9 - 23	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/2	4.9 - 36	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/2	4.9 - 35	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/2	9.8 - 77	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	700	770	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/2	9.8	770	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/2	4.9 - 27	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/2	4.9 - 67	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/2	4.9 - 10	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/2	4.9 - 22	N/A	8100	N	N	ND
108-88-3	Toluene	0.38 J	200 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	2/2	--	200 J	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	46 J	53 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/2	4.9	53 J	160000	N	N	BSV

Table 2.25

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/2	4.9 - 15	N/A	1800	C	N	ND
79-01-6	Trichloroethene	75 J	96 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/2	4.9	96 J	410	N	N	BSV
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/2	4.9 - 35	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/2	4.9 - 24	N/A	670000	N	N	ND
75-01-4	**Vinyl chloride**	**78 J**	**89 J**	**µg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/2**	**4.9**	**89 J**	**59**	**C**	**Y**	**ASV**
1330-20-7	Xylenes (total)	42 J	63 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/2	9.8	63 J	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/1	100	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/1	260 - 270	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/1	94 - 96	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/1	210	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/1	210	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/1	220 - 230	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/1	180	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/1	220 - 230	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/1	4.8	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/1	87 - 88	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	300	440	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	440	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/1	120	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/1	96 - 98	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/1	88 - 89	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/1	210	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/1	190	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/1	170	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/1	97 - 99	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/1	140	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/1	220 - 230	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/1	180	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/1	140	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/1	280	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/1	180	N/A	--		N	ND
83-32-9	Acenaphthene	49 J	49 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	8.2	49 J	360000	N	N	BSV
208-96-8	Acenaphthylene	ND	ND	µg/kg	--	0/1	3.7 - 3.8	N/A	360000 (5)	N	N	ND
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/1	97 - 99	N/A	780000	N	N	ND
120-12-7	Anthracene	69 J	78	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	78	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/1	96 - 98	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/kg	--	0/1	130	N/A	170000	N	N	ND
56-55-3	Benzo(a)anthracene	280 J	500 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	500 J	1100	C	N	BSV
50-32-8	**Benzo(a)pyrene**	**370 J**	**780 J**	**µg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**780 J**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**720 J**	**1800 J**	**µg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**1800 J**	**1100**	**C**	**Y**	**ASV**

Table 2.25

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	160 J	520 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	520 J	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	190 J	600 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	600 J	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	81 J	92 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	92 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/1	230 - 240	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/1	21	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	510 J	510 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	200	510 J	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/1	110	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/1	390 - 400	N/A	3100000	N	N	ND
86-74-8	Carbazole	ND	ND	µg/kg	--	0/1	290	N/A	--		N	ND
218-01-9	Chrysene	350 J	800 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	800 J	110000	C	N	BSV
53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/kg	--	0/1	7 - 7.1	N/A	110	C	N	ND
132-64-9	Dibenzofuran	98 J	140 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	140 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/1	170	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/1	180	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/kg	--	0/1	160	N/A	630000	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/1	84 - 85	N/A	63000	N	N	ND
206-44-0	Fluoranthene	640	730	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	730	240000	N	N	BSV
86-73-7	Fluorene	63 J	95	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	95	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/1	22 - 23	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/1	59 - 60	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/1	86 - 87	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/1	95 - 97	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	190 J	420 J	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	420 J	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/1	140	N/A	570000	C	N	ND
91-20-3	Naphthalene	230	350	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	350	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/1	23 - 24	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/1	67 - 68	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/1	220 - 230	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/1	96 - 98	N/A	1000	C	N	ND
85-01-8	Phenanthrene	510	570	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	570	180000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/1	77 - 78	N/A	1900000	N	N	ND
129-00-0	Pyrene	670	810	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	810	180000	N	N	BSV
	Metals											
7429-90-5	Aluminum	2400	4500	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	4500	7700	N	N	BSV
7440-36-0	Antimony	0.41 J	0.42 J	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	0.42 J	3.1	N	N	BSV
7440-38-2	**Arsenic**	**5.2**	**6.2**	**mg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**6.2**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	79	130	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	130	1500	N	N	BSV
7440-41-7	Beryllium	0.33	0.41	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	0.41	16	N	N	BSV
7440-43-9	Cadmium	0.28	0.42	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	0.42	7.1	N	N	BSV
7440-70-2	Calcium	49000	110000	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	110000	--		N	NAT
16065-83-1	Chromium III (trivalent)	44	60	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	60	12000	N	N	BSV

Table 2.25

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**1**	**1**	**mg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**0.26**	**1**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**3**	**3.6**	**mg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**3.6**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	190	200	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	200	310	N	N	BSV
57-12-5	Cyanide (total)	0.13 J	0.21 J	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	0.21 J	2.3	N	N	BSV
7439-89-6	**Iron**	**11000**	**23000**	**mg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**23000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	120	180	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	180	400	C	N	BSV
7439-95-4	Magnesium	24000	45000	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	45000	--		N	NAT
7439-96-5	**Manganese**	**230**	**360**	**mg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**360**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.81 J	0.81 J	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	0.021	0.81 J	1.1	N	N	BSV
7440-02-0	Nickel	11	12	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	12	150	N	N	BSV
7440-09-7	Potassium	380	560	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	560	--		N	NAT
7782-49-2	Selenium	0.52 J	0.65 J	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	0.65 J	39	N	N	BSV
7440-22-4	Silver	0.32 J	5.0 J	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	5.0 J	39	N	N	BSV
7440-23-5	Sodium	190	260	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	260	--		N	NAT
7440-28-0	**Thallium**	**0.086 J**	**0.10 J**	**mg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**0.10 J**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	11	12	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	12	39	N	N	BSV
7440-66-6	Zinc	39	87	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	87	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/1	23 - 110	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/1	25 - 130	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/1	24 - 120	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/1	20 - 99	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/1	25 - 130	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**440 J**	**2000 J**	**µg/kg**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**2000 J**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/1	23 - 110	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/1	34 - 69	N/A	190	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/1	12 - 25	N/A	2000	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/kg	--	0/1	14 - 29	N/A	1900	C	N	ND
309-00-2	Aldrin	ND	ND	µg/kg	--	0/1	25 - 50	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/1	16 - 33	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/1	39 - 79	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/1	40 - 81	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/1	13 - 27	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/1	9.3 - 19	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/1	13 - 27	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/1	19 - 38	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/1	12 - 25	N/A	38000	N	N	ND

Table 2.25

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/1	14 - 29	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/1	19 - 38	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/1	11 - 23	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/1	30 - 61	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/1	15 - 31	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/1	8 - 16	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/1	25 - 50	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/1	12 - 25	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/1	380 - 770	N/A	490	C	N	ND
	Herbicides											
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/0	--	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/0	--	N/A	70000	N	N	ND
	Dioxins/Furans											
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	35	43 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	43 J	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	410	480	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	480	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	85	120	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	120	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	120	140	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	140	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	6.9	8.5 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	8.5 J	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	48 J	65	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	65	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	4.0 J	4.0 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	0.39	4.0 J	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	16	23 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	23 J	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	16 J	18	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	18	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.88 J	0.88 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	2	0.88 J	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	15	16 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	16 J	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	15 J	15 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	15 J	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	ND	ND	pg/g	--	0/1	6.3 - 15	N/A	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	17	21 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	21 J	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	29 J	30	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	30	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	110	200	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	200	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	1.3 J	2.0 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	2.0 J	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	140 J	180 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	180 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	260 J	300 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	300 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	190 J	230 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	230 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	150 J	160 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	160 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	290 J	300 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	300 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	5900 J	12000 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	12000 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	600 J	720 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	720 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	38 J	60 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/1	--	60 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**37.4929**	**46.4895**	**pg/g**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**46.4895**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**45.0124**	**49.7395**	**pg/g**	**BH136-18: 1-3 ft BGS (1/8/2018)**	**1/1**	**--**	**49.7395**	**4.8**	**C**	**Y**	**(6)**

Table 2.25

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos										
1332-21-4	Asbestos	ND	ND	%	--	0/1	1	N/A	--	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH36-13, BH136-18.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.26

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/22	0.24 - 3100	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/21	0.27 - 3100	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	8.3	8.3	µg/kg	BH08-09: 3-5 ft BGS (6/20/2009)	1/22	0.41 - 3100	8.3	150	N	N	BSV
75-34-3	**1,1-Dichloroethane**	**0.46 J**	**280 J**	**µg/kg**	**BH38-13: 2-4 ft BGS (6/27/2013)**	**3/22**	**0.34 - 3100**	**280 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	3.5 J	49 J	µg/kg	BH38-13: 2-4 ft BGS (6/27/2013)	3/22	0.56 - 3100	49 J	23000	N	N	BSV
120-82-1	1,2,4-Trichlorobenzene	24 J	24 J	µg/kg	TP-5: 12 ft BGS (10/6/2008)	1/21	0.25 - 3100	24 J	5800	N	N	BSV
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/21	0.71 - 6300	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/22	0.36 - 3100	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	42 J	47 J	µg/kg	TT-21: 8 ft BGS (10/8/2008)	2/21	0.23 - 3100	47 J	180000	N	N	BSV
107-06-2	1,2-Dichloroethane	49	49	µg/kg	BH08-09: 3-5 ft BGS (6/20/2009)	1/22	0.3 - 3100	49	460	C	N	BSV
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/22	0.32 - 3100	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	44 J	44 J	µg/kg	TP-5: 12 ft BGS (10/6/2008)	1/21	0.3 - 3100	44 J	180000 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	17 J	89 J	µg/kg	TT-7: 6 ft BGS (10/7/2008)	3/21	0.36 - 3100	89 J	2600	C	N	BSV
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	2.1 J	170 J	µg/kg	BH141-18: 6-8 ft BGS (1/9/2018)	7/22	1.6 - 13000	170 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/22	0.6 - 13000	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.90 J	900 J	µg/kg	BH42-13: 2-4 ft BGS (7/1/2013)	3/22	0.93 - 12000	900 J	3300000	N	N	BSV
67-64-1	Acetone	9.9 J	1400 J	µg/kg	BH141-18: 6-8 ft BGS (1/9/2018)	5/22	4 - 13000	1400 J	6100000	N	N	BSV
71-43-2	Benzene	1.5 J	530 J	µg/kg	TT-22: 6 ft BGS (10/8/2008)	10/22	0.33 - 1800	530 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/22	0.34 - 3100	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/22	0.42 - 3100	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/22	0.61 - 3100	N/A	680	N	N	ND
75-15-0	Carbon disulfide	0.38 J	6.4 J	µg/kg	TP-6: 11 ft BGS (10/6/2008)	5/22	0.27 - 3100	6.4 J	77000	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/22	0.26 - 3100	N/A	650	C	N	ND
108-90-7	**Chlorobenzene**	**14 J**	**100000**	**µg/kg**	**GP01-18: 5.5-6.5 ft bgs (1/25/2018)**	**6/22**	**0.34 - 3100**	**100000**	**28000**	**N**	**Y**	**ASV**
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/22	0.4 - 3100	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/22	0.24 - 3100	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/22	0.4 - 3100	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.39 J	4200	µg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	12/22	0.29 - 1800	4200	16000	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/22	0.27 - 3100	N/A	1800	C	N	ND
110-82-7	Cyclohexane	1.8 J	600 J	µg/kg	BH38-13: 2-4 ft BGS (6/27/2013)	4/22	0.22 - 6300	600 J	650000	N	N	BSV
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/22	0.31 - 3100	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/22	0.36 - 3100	N/A	8700	N	N	ND
100-41-4	**Ethylbenzene**	**6.8**	**210000 J**	**µg/kg**	**TT-24: 13-15 ft BGS (3/20/2018)**	**11/22**	**0.28 - 670**	**210000 J**	**5800**	**C**	**Y**	**ASV**
98-82-8	Isopropyl benzene	0.41 J	15000 J	µg/kg	TT-24: 13-15 ft BGS (3/20/2018)	8/22	0.21 - 1800	15000 J	190000	N	N	BSV
79-20-9	Methyl acetate	65 J	690 J	µg/kg	BH42-13: 2-4 ft BGS (7/1/2013)	5/22	1.2 - 3600	690 J	7800000	N	N	BSV
108-87-2	Methyl cyclohexane	0.44 J	14000 J	µg/kg	TT-24: 13-15 ft BGS (3/20/2018)	12/22	0.24 - 3600	14000 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/22	0.28 - 7100	N/A	47000	C	N	ND
75-09-2	Methylene chloride	0.84 J	30	µg/kg	TT-24: 2-4 ft bgs (3/20/2018)	2/22	0.33 - 6100	30	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/22	0.28 - 3100	N/A	600000	N	N	ND
127-18-4	**Tetrachloroethene**	**0.56 J**	**40000**	**µg/kg**	**BH139-18: 13-15 ft BGS (1/4/2018)**	**5/22**	**0.39 - 3000**	**40000**	**8100**	**N**	**Y**	**ASV**
108-88-3	Toluene	0.38 J	12000	µg/kg	BH42-13: 2-4 ft BGS (7/1/2013)	15/22	0.47 - 1800	12000	490000	N	N	BSV

Table 2.26

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
156-60-5	trans-1,2-Dichloroethene	0.95 J	290 J	µg/kg	BH42-13: 2-4 ft BGS (7/1/2013)	6/22	0.4 - 1800	290 J	160000	N	N	BSV
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/22	0.22 - 3100	N/A	1800	C	N	ND
79-01-6	**Trichloroethene**	**0.51 J**	**25000**	**µg/kg**	**BH139-18: 13-15 ft BGS (1/4/2018)**	**11/22**	**0.6 - 3100**	**25000**	**410**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/22	0.25 - 3100	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/22	0.51 - 3100	N/A	670000	N	N	ND
75-01-4	**Vinyl chloride**	**3.0 J**	**200 J**	**µg/kg**	**BH38-13: 2-4 ft BGS (6/27/2013)**	**5/22**	**0.29 - 3100**	**200 J**	**59**	**C**	**Y**	**ASV**
1330-20-7	**Xylenes (total)**	**1.9 J**	**590000 J**	**µg/kg**	**TT-24: 13-15 ft BGS (3/20/2018)**	**12/22**	**0.42 - 530**	**590000 J**	**58000**	**N**	**Y**	**ASV**
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/15	13 - 3000	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/15	35 - 4500	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/15	12 - 4500	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/15	28 - 4500	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/15	28 - 4500	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/15	29 - 9900	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/15	24 - 6000	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/15	29 - 6000	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/15	0.63 - 1500	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/15	11 - 1500	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	17 J	4800	µg/kg	TT-24: 13-15 ft BGS (3/20/2018)	12/15	8.2 - 82	4800	240000	N	N	BSV
95-48-7	2-Methylphenol	25 J	25 J	µg/kg	BH138-18: 8-10 ft BGS (1/9/2018)	1/15	19 - 6000	25 J	320000	N	N	BSV
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/15	13 - 6000	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/15	12 - 1500	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	35 J	98 J	µg/kg	BH137-18: 13-15 ft BGS (1/8/2018)	2/9	34 - 1200	98 J	320000 (5)	N	N	BSV
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/15	25 - 3000	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/15	22 - 6000	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/6	240 - 6000	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/15	13 - 4500	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/15	18 - 1500	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/15	29 - 4500	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/15	24 - 4500	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/15	18 - 1500	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/15	36 - 6000	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/15	24 - 9900	N/A	--		N	ND
83-32-9	Acenaphthene	33	2600	µg/kg	TT-7: 6 ft BGS (10/7/2008)	6/15	1.1 - 200	2600	360000	N	N	BSV
208-96-8	Acenaphthylene	8.7 J	27	µg/kg	BH141-18: 6-8 ft BGS (1/9/2018)	2/15	0.49 - 200	27	360000 (5)	N	N	BSV
98-86-2	Acetophenone	130 J	130 J	µg/kg	BH138-18: 8-10 ft BGS (1/9/2018)	1/15	16 - 3000	130 J	780000	N	N	BSV
120-12-7	Anthracene	33	2900	µg/kg	TT-7: 6 ft BGS (10/7/2008)	5/15	1.1 - 200	2900	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/15	13 - 6000	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	36 J	150	µg/kg	BH138-18: 8-10 ft BGS (1/9/2018)	2/15	20 - 3000	150	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**11 J**	**6400**	**µg/kg**	**TT-7: 6 ft BGS (10/7/2008)**	**9/15**	**8.2 - 200**	**6400**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**31**	**4500**	**µg/kg**	**TT-7: 6 ft BGS (10/7/2008)**	**7/15**	**1.1 - 170**	**4500**	**110**	**C**	**Y**	**ASV**

Table 2.26

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
205-99-2	**Benzo(b)fluoranthene**	**9.0 J**	**6200**	**µg/kg**	**TT-7: 6 ft BGS (10/7/2008)**	**11/15**	**8.2 - 170**	**6200**	**1100**	**C**	**Y**	**ASV**
191-24-2	Benzo(g,h,i)perylene	16	2300	µg/kg	TT-7: 6 ft BGS (10/7/2008)	7/15	0.6 - 170	2300	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	16	2400	µg/kg	TT-7: 6 ft BGS (10/7/2008)	7/15	1.2 - 170	2400	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	15 J	740 J	µg/kg	TT-24: 13-15 ft BGS (3/20/2018)	9/15	60 - 1500	740 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/15	31 - 3000	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/15	2.8 - 3000	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	270	2000	µg/kg	BH140-18: 13-15 ft BGS (1/8/2018)	3/15	26 - 4100	2000	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/15	14 - 1500	N/A	290000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/15	51 - 9900	N/A	3100000	N	N	ND
86-74-8	Carbazole	ND	ND	µg/kg	--	0/15	38 - 1700	N/A	--		N	ND
218-01-9	Chrysene	11 J	5700	µg/kg	TT-7: 6 ft BGS (10/7/2008)	11/15	8.2 - 82	5700	110000	C	N	BSV
53-70-3	Dibenz(a,h)anthracene	53	53	µg/kg	TT-24: 2-4 ft bgs (3/20/2018)	1/15	0.92 - 200	53	110	C	N	BSV
132-64-9	Dibenzofuran	20 J	860 J	µg/kg	TT-7: 6 ft BGS (10/7/2008)	5/15	1.1 - 1500	860 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	36 J	690 J	µg/kg	BH139-18: 13-15 ft BGS (1/4/2018)	2/15	22 - 1500	690 J	5100000	N	N	BSV
131-11-3	Dimethyl phthalate	680	680	µg/kg	BH141-18: 6-8 ft BGS (1/9/2018)	1/15	24 - 1500	680	5100000 (5)	N	N	BSV
84-74-2	Di-n-butylphthalate (DBP)	63 J	6000	µg/kg	TT-24: 13-15 ft BGS (3/20/2018)	5/15	60 - 1500	6000	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/15	11 - 1500	N/A	63000	N	N	ND
206-44-0	Fluoranthene	21 J	21000	µg/kg	TT-7: 6 ft BGS (10/7/2008)	14/15	8.2	21000	240000	N	N	BSV
86-73-7	Fluorene	12 J	2000	µg/kg	TT-7: 6 ft BGS (10/7/2008)	8/15	0.74 - 200	2000	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/15	2.9 - 200	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/15	7.8 - 1500	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/14	11 - 9900	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/15	13 - 1500	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**13**	**2300**	**µg/kg**	**TT-7: 6 ft BGS (10/7/2008)**	**6/15**	**0.6 - 170**	**2300**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/15	18 - 1500	N/A	570000	C	N	ND
91-20-3	**Naphthalene**	**14 J**	**9800**	**µg/kg**	**TT-24: 13-15 ft BGS (3/20/2018)**	**12/15**	**8.2 - 82**	**9800**	**3800**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/15	3.1 - 3000	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/15	8.8 - 1500	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	100 J	100 J	µg/kg	BH137-18: 13-15 ft BGS (1/8/2018)	1/15	29 - 1500	100 J	110000	C	N	BSV
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/15	13 - 4500	N/A	1000	C	N	ND
85-01-8	Phenanthrene	27	6800	µg/kg	TT-7: 6 ft BGS (10/7/2008)	14/15	8.2	6800	180000 (5)	N	N	BSV
108-95-2	Phenol	640	980 J	µg/kg	BH139-18: 13-15 ft BGS (1/4/2018)	3/15	10 - 1500	980 J	1900000	N	N	BSV
129-00-0	Pyrene	15 J	13000	µg/kg	TT-7: 6 ft BGS (10/7/2008)	14/15	8.2	13000	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**2400**	**20700**	**mg/kg**	**TT-22: 6 ft BGS (10/8/2008)**	**15/15**	**--**	**20700**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.41 J**	**191 J**	**mg/kg**	**TT-22: 6 ft BGS (10/8/2008)**	**15/15**	**--**	**191 J**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**5.2**	**30**	**mg/kg**	**BH138-18: 8-10 ft BGS (1/9/2018)**	**15/15**	**--**	**30**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**23.7 J**	**7810**	**mg/kg**	**TP-5: 12 ft BGS (10/6/2008)**	**15/15**	**--**	**7810**	**1500**	**N**	**Y**	**ASV**
7440-41-7	Beryllium	0.23	6.9	mg/kg	BH141-18: 6-8 ft BGS (1/9/2018)	15/15	--	6.9	16	N	N	BSV
7440-43-9	**Cadmium**	**0.28**	**29**	**mg/kg**	**BH140-18: 13-15 ft BGS (1/8/2018)**	**14/15**	**0.6**	**29**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	2600 J	146000	mg/kg	TP-6: 11 ft BGS (10/6/2008)	15/15	--	146000	--		N	NAT

Table 2.26

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
16065-83-1	Chromium III (trivalent)	7.7	320	mg/kg	BH142-18: 8-10 ft BGS (1/4/2018)	15/15	--	320	12000	N	N	BSV
18540-29-9	**Chromium VI (hexavalent)**	**1**	**26**	**mg/kg**	**TP-5: 12 ft BGS (10/6/2008)**	**11/15**	**0.26 - 3**	**26**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**2.9 J**	**37**	**mg/kg**	**BH139-18: 13-15 ft BGS (1/4/2018)**	**15/15**	**--**	**37**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**29**	**7340 J**	**mg/kg**	**TT-7: 6 ft BGS (10/7/2008)**	**15/15**	**--**	**7340 J**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.12 J**	**11**	**mg/kg**	**TT-24: 13-15 ft BGS (3/20/2018)**	**11/14**	**0.15 - 0.64**	**11**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**5700**	**210000**	**mg/kg**	**BH142-18: 8-10 ft BGS (1/4/2018)**	**15/15**	**--**	**210000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**9.4 J**	**16000**	**mg/kg**	**BH139-18: 13-15 ft BGS (1/4/2018)**	**15/15**	**--**	**16000**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	722	97000	mg/kg	BH139-18: 13-15 ft BGS (1/4/2018)	15/15	--	97000	--		N	NAT
7439-96-5	**Manganese**	**37**	**1400**	**mg/kg**	**BH142-18: 8-10 ft BGS (1/4/2018)**	**15/15**	**--**	**1400**	**180**	**N**	**Y**	**ASV**
7439-97-6	**Mercury**	**0.035 J**	**3.9**	**mg/kg**	**BH140-18: 13-15 ft BGS (1/8/2018)**	**14/15**	**0.021 - 0.12**	**3.9**	**1.1**	**N**	**Y**	**ASV**
7440-02-0	**Nickel**	**10**	**860**	**mg/kg**	**BH142-18: 8-10 ft BGS (1/4/2018)**	**15/15**	**--**	**860**	**150**	**N**	**Y**	**ASV**
7440-09-7	Potassium	262 J	1270	mg/kg	TP-6: 11 ft BGS (10/6/2008)	15/15	--	1270	--		N	NAT
7782-49-2	Selenium	0.52 J	38	mg/kg	BH141-18: 6-8 ft BGS (1/9/2018)	11/15	30.8 - 161	38	39	N	N	BSV
7440-22-4	Silver	0.10 J	5.0 J	mg/kg	BH136-18: 1-3 ft BGS (1/8/2018)	14/15	1.2	5.0 J	39	N	N	BSV
7440-23-5	Sodium	110 J	1510	mg/kg	TP-5: 12 ft BGS (10/6/2008)	14/15	599	1510	--		N	NAT
7440-28-0	**Thallium**	**0.086 J**	**2.4**	**mg/kg**	**BH141-18: 6-8 ft BGS (1/9/2018)**	**10/15**	**0.12 - 3**	**2.4**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**11**	**79**	**mg/kg**	**BH141-18: 6-8 ft BGS (1/9/2018)**	**15/15**	**--**	**79**	**39**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**26.9**	**19000**	**mg/kg**	**BH140-18: 13-15 ft BGS (1/8/2018)**	**15/15**	**--**	**19000**	**2300**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/16	22 - 2100	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/16	24 - 2100	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/16	23 - 2100	N/A	170	C	N	ND
53469-21-9	**Aroclor-1242 (PCB-1242)**	**53**	**29000**	**µg/kg**	**BH140-18: 13-15 ft BGS (1/8/2018)**	**6/16**	**19 - 120**	**29000**	**230**	**C**	**Y**	**ASV**
12672-29-6	Aroclor-1248 (PCB-1248)	59 J	160	µg/kg	TT-24: 2-4 ft bgs (3/20/2018)	2/16	25 - 2100	160	230	C	N	BSV
11097-69-1	**Aroclor-1254 (PCB-1254)**	**51**	**10000**	**µg/kg**	**BH140-18: 13-15 ft BGS (1/8/2018)**	**10/16**	**23 - 41**	**10000**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	58 J	63	µg/kg	TT-24: 2-4 ft bgs (3/20/2018)	2/16	23 - 2100	63	240	C	N	BSV
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	190	C	N	ND
72-55-9	4,4'-DDE	93 J	93 J	µg/kg	TT-7: 6 ft BGS (10/7/2008)	1/14	2.1 - 260	93 J	2000	C	N	BSV
50-29-3	4,4'-DDT	110 J	110 J	µg/kg	TP-5: 12 ft BGS (10/6/2008)	1/14	2.1 - 260	110 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	1700	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	300	C	N	ND
319-86-8	delta-BHC	130 J	130 J	µg/kg	BH141-18: 6-8 ft BGS (1/9/2018)	1/14	2.1 - 260	130 J	300	C	N	BSV
60-57-1	**Dieldrin**	**68 J**	**68 J**	**µg/kg**	**TP-5: 12 ft BGS (10/6/2008)**	**1/14**	**2.1 - 260**	**68 J**	**34**	**C**	**Y**	**ASV**
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	38000	N	N	ND

Table 2.26

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	1900	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	1700	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/14	2.1 - 260	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/14	4.1 - 500	N/A	32000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/14	82 - 10000	N/A	490	C	N	ND
	Herbicides											
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/5	25 - 2600	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/5	98 - 10000	N/A	70000	N	N	ND
	Dioxins/Furans											
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	7.4 J	730	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	9/9	--	730	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	44	6300	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	9/9	--	6300	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	6.0 J	870	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	9/9	--	870	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	8.9	1400	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	9/9	--	1400	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	0.33 J	68	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	9/9	--	68	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	3.5 J	340	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	9/9	--	340	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.30 J	48 J	pg/g	BH137-18: 13-15 ft BGS (1/8/2018)	9/9	0.39	48 J	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	3.8 J	110 J	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	9/9	--	110 J	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	1.1 J	810	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	9/9	--	810	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.88 J	0.88 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	1/9	0.34 - 8	0.88 J	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	1.0 J	510	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	9/9	--	510	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.84 J	66	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	9/9	--	66	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.83 J	430	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	8/9	6.3 - 15	430	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.8 J	140	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	8/9	1.5	140	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	1.8 J	110	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	9/9	--	110	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	3.7	200	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	9/9	--	200	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.50 J	180	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	8/9	0.13	180	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	12 J	1700 J	pg/g	TT-24: 13-15 ft BGS (3/20/2018)	9/9	--	1700 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	16 J	3800 J	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	9/9	--	3800 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	75 J	1400 J	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	9/9	--	1400 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	11 J	8700 J	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	9/9	--	8700 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	140 J	1800 J	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	9/9	--	1800 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	9.9 J	12000 J	pg/g	BH136-18: 1-3 ft BGS (1/8/2018)	9/9	--	12000 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	180 J	2800 J	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	9/9	--	2800 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	10 J	7900 J	pg/g	BH142-18: 8-10 ft BGS (1/4/2018)	9/9	--	7900 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**4.2693**	**826.164**	**pg/g**	**BH142-18: 8-10 ft BGS (1/4/2018)**	**9/9**	**--**	**826.164**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**4.3828**	**826.564**	**pg/g**	**BH142-18: 8-10 ft BGS (1/4/2018)**	**9/9**	**--**	**826.564**	**4.8**	**C**	**Y**	**(6)**

Table 2.26

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos										
1332-21-4	Asbestos	ND	ND	%	--	0/7	1	N/A	--	N	ND
12001-29-5	**Chrysotile asbestos**	**10**	**60**	**%**	**VAS-5: 7 ft BGS (12/15/2008)**	**2/3**	**1**	**60**	**--**	**Y**	**AD**

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: BH13-13, BH34-13, BH36-13, BH38-13, BH42-13, BH44-13, BH136-18, BH137-18, BH138-18, BH139-18, BH140-18, BH141-18, BH142-18, GP01-18, GP32-18, TP-5, TP-6, TT-7, TT-21, TT-22, TT-24, VAS-5.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyt Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.27

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU17 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	ug/kg	--	0/11	0.29 - 1.1	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	ug/kg	--	0/10	0.33 - 2	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	ug/kg	--	0/11	0.49 - 1.6	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	ug/kg	--	0/11	0.42 - 0.95	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	ug/kg	--	0/11	0.68 - 1.2	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	ug/kg	--	0/10	0.3 - 0.78	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	ug/kg	--	0/10	0.86 - 4.9	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	ug/kg	--	0/11	0.44 - 1.1	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	ug/kg	--	0/10	0.28 - 1.5	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	ug/kg	--	0/11	0.37 - 1.1	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	ug/kg	--	0/11	0.39 - 1.2	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	ug/kg	--	0/10	0.37 - 1.1	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	ug/kg	--	0/10	0.44 - 1.2	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ND	ND	ug/kg	--	0/11	1.6 - 4.9	N/A	2700000	N	N	ND
591-78-6	2-Hexanone	ND	ND	ug/kg	--	0/11	0.73 - 5.6	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	ug/kg	--	0/11	1.1 - 5.1	N/A	3300000	N	N	ND
67-64-1	Acetone	ND	ND	ug/kg	--	0/11	11 - 29	N/A	6100000	N	N	ND
71-43-2	Benzene	ND	ND	ug/kg	--	0/11	0.4 - 0.96	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	ug/kg	--	0/11	0.42 - 0.93	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	ug/kg	--	0/11	0.5 - 3.3	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	ug/kg	--	0/11	0.74 - 1.4	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	ug/kg	--	0/11	0.26 - 1.6	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	ug/kg	--	0/11	0.32 - 4.5	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	ug/kg	--	0/11	0.42 - 1.3	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	ug/kg	--	0/11	0.48 - 1.7	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	ug/kg	--	0/11	0.29 - 1.1	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	ug/kg	--	0/11	0.48 - 1.4	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	ug/kg	--	0/11	0.35 - 0.89	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	ug/kg	--	0/11	0.33 - 2	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	ug/kg	--	0/11	0.26 - 1.9	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	ug/kg	--	0/11	0.38 - 3.8	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	ug/kg	--	0/11	0.44 - 1.3	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	ug/kg	--	0/11	0.34 - 1.4	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	ug/kg	--	0/11	0.25 - 1.1	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	ug/kg	--	0/11	1.5 - 4.7	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	ug/kg	--	0/11	0.29 - 1.7	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	ug/kg	--	0/11	0.34 - 1.1	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	ug/kg	--	0/11	1.7 - 16	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	ug/kg	--	0/11	0.34 - 1.6	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	1.5 J	2.4 J	ug/kg	SS-6: 0.33-2.33 ft BGS (12/20/2018)	2/11	0.47 - 0.92	2.4 J	8100	N	N	BSV
108-88-3	Toluene	ND	ND	ug/kg	--	0/11	0.43 - 1.1	N/A	490000	N	N	ND
156-60-5	trans-1,2-Dichloroethene	ND	ND	ug/kg	--	0/11	0.41 - 0.83	N/A	160000	N	N	ND

Table 2.27

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU17 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	ug/kg	--	0/11	0.26 - 1.4	N/A	1800	C	N	ND
79-01-6	Trichloroethene	0.89 J	1.4 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	1/11	0.52 - 0.89	1.4 J	410	N	N	BSV
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	ug/kg	--	0/11	0.3 - 1.5	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	ug/kg	--	0/11	0.62 - 1.8	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	ug/kg	--	0/11	0.35 - 1.1	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	ug/kg	--	0/11	0.5 - 2.2	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	ug/kg	--	0/11	11 - 80	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	ug/kg	--	0/11	28 - 260	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	ug/kg	--	0/11	9.9 - 240	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	ug/kg	--	0/11	22 - 170	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	ug/kg	--	0/11	22 - 170	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	ug/kg	--	0/10	23 - 530	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	ug/kg	--	0/11	19 - 230	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	ug/kg	--	0/11	23 - 210	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	ug/kg	--	0/11	0.5 - 53	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	ug/kg	--	0/11	9.1 - 69	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	6.8 J	120	ug/kg	SS-9: 0-2 ft BGS (12/20/2018)	11/11	--	120	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	ug/kg	--	0/11	12 - 120	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	ug/kg	--	0/11	10 - 150	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	ug/kg	--	0/11	9.2 - 70	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	ug/kg	--	0/11	22 - 170	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	ug/kg	--	0/11	20 - 160	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	ug/kg	--	0/11	18 - 180	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	ug/kg	--	0/11	10 - 300	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	ug/kg	--	0/11	14 - 110	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	ug/kg	--	0/11	23 - 180	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	ug/kg	--	0/11	19 - 140	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	ug/kg	--	0/11	14 - 110	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	ug/kg	--	0/11	29 - 230	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	ug/kg	--	0/11	19 - 350	N/A	--		N	ND
83-32-9	Acenaphthene	10 J	61	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	8/11	3.2 - 11	61	360000	N	N	BSV
208-96-8	Acenaphthylene	9.1 J	46 J	ug/kg	SS-7: 0-2 ft BGS (12/20/2018)	9/11	0.48 - 4.8	46 J	360000 (5)	N	N	BSV
98-86-2	Acetophenone	14 J	22 J	ug/kg	SS-7: 0-2 ft BGS (12/20/2018)	4/11	10 - 78	22 J	780000	N	N	BSV
120-12-7	Anthracene	5.5 J	310 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	310 J	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	ug/kg	--	0/11	10 - 140	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	27 J	30 J	ug/kg	SS-7: 0-2 ft BGS (12/20/2018)	2/11	13 - 100	30 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**24**	**1500 J**	**ug/kg**	**SS-5: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**1500 J**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**24**	**1300**	**ug/kg**	**SS-5: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**1300**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**37**	**1900**	**ug/kg**	**SS-5: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**1900**	**1100**	**C**	**Y**	**ASV**

Table 2.27

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU17 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	19	610 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	610 J	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	9.3 J	820 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	820 J	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	6.3 J	13 J	ug/kg	SS-3: 0.3-2.3 ft BGS (11/9/2017)	2/11	3.9 - 64	13 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	ug/kg	--	0/11	13 - 190	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	ug/kg	--	0/11	2.2 - 45	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	27 J	5100 J	ug/kg	SS-3: 0.3-2.3 ft BGS (11/9/2017)	7/11	57 - 190	5100 J	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	75 J	580	ug/kg	SS-7: 0-2 ft BGS (12/20/2018)	2/11	11 - 84	580	290000	C	N	BSV
105-60-2	Caprolactam	ND	ND	ug/kg	--	0/11	41 - 310	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**51 J**	**110 J**	**ug/kg**	**SS-5: 0.33-2.33 ft BGS (12/20/2018)**	**3/11**	**21 - 230**	**110 J**	**--**		**Y**	**AD**
218-01-9	Chrysene	25	1400 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	1400 J	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**27**	**200 J**	**ug/kg**	**SS-5: 0.33-2.33 ft BGS (12/20/2018)**	**8/11**	**0.9 - 8.3**	**200 J**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	15 J	43 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	7/11	5.6 - 49	43 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	ug/kg	--	0/11	18 - 130	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	ug/kg	--	0/11	15 - 140	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	20 J	150 J	ug/kg	SS-3: 0.3-2.3 ft BGS (11/9/2017)	5/11	25 - 83	150 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	ug/kg	--	0/11	8.8 - 110	N/A	63000	N	N	ND
206-44-0	Fluoranthene	39	3200 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	3200 J	240000	N	N	BSV
86-73-7	Fluorene	5.4 J	61	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	9/11	3.3 - 10	61	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	ug/kg	--	0/11	2.3 - 18	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	ug/kg	--	0/11	6.2 - 47	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	ug/kg	--	0/10	9 - 230	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	ug/kg	--	0/11	9.9 - 76	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	15 J	580 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	580 J	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	ug/kg	--	0/11	13 - 110	N/A	570000	C	N	ND
91-20-3	Naphthalene	9.5 J	80	ug/kg	SS-3: 0.3-2.3 ft BGS (11/9/2017)	9/11	2.9 - 9.1	80	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	ug/kg	--	0/11	2.5 - 49	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	ug/kg	--	0/11	7 - 53	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	ug/kg	--	0/11	13 - 180	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	ug/kg	--	0/11	10 - 220	N/A	1000	C	N	ND
85-01-8	Phenanthrene	21	1100	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	1100	180000 (5)	N	N	BSV
108-95-2	Phenol	19 J	19 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	1/11	8.1 - 62	19 J	1900000	N	N	BSV
129-00-0	Pyrene	32	1900	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	1900	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**4300 J**	**14000**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**14000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.2**	**260**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**260**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**6.2**	**29**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**29**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**86**	**1800**	**mg/kg**	**SS-10: 0-2 ft BGS (12/20/2018)**	**11/11**	**--**	**1800**	**1500**	**N**	**Y**	**ASV**
7440-41-7	Beryllium	0.32	3.9	mg/kg	SS-2: 0.2-2.2 ft BGS (11/9/2017)	11/11	--	3.9	16	N	N	BSV
7440-43-9	**Cadmium**	**0.24**	**20**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**20**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	8100 J	110000 J	mg/kg	SS-1: 0-2 ft BGS (11/9/2017)	11/11	--	110000 J	--		N	NAT
16065-83-1	Chromium III (trivalent)	8.1	99	mg/kg	SS-6: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	99	12000	N	N	BSV

Table 2.27

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU17 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.31 J**	**5.4**	**mg/kg**	**SS-3: 0.3-2.3 ft BGS (11/9/2017)**	**5/11**	**1.3 - 3.3**	**5.4**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**4.2 J**	**67 J**	**mg/kg**	**SS-5: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**67 J**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**19 J**	**6000 J**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**6000 J**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.29 J**	**13 J**	**mg/kg**	**SS-3: 0.3-2.3 ft BGS (11/9/2017)**	**5/7**	**0.5 - 0.63**	**13 J**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**8300 J**	**40000**	**mg/kg**	**SS-5: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**40000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**20**	**2400**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**2400**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - coarse fraction**	**20 J**	**4500 J**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**5/5**	**--**	**4500 J**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - fine fraction**	**47**	**2500**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**5/5**	**--**	**2500**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - total (calculated by fine/coarse fraction)**	**22**	**4100**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**5/5**	**--**	**4100**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	2500	46000	mg/kg	SS-11: 0-2 ft BGS (12/20/2018)	11/11	--	46000	--		N	NAT
7439-96-5	**Manganese**	**140 J**	**760**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**760**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.052 J	0.39	mg/kg	SS-3: 0.3-2.3 ft BGS (11/9/2017)	11/11	--	0.39	1.1	N	N	BSV
7440-02-0	**Nickel**	**11 J**	**330**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**330**	**150**	**N**	**Y**	**ASV**
7440-09-7	Potassium	620 J	1500 J	mg/kg	SS-6: 0.33-2.33 ft BGS (12/20/2018)	11/11	--	1500 J	--		N	NAT
7782-49-2	Selenium	0.29 J	2.8 J	mg/kg	SS-2: 0.2-2.2 ft BGS (11/9/2017)	10/11	0.66	2.8 J	39	N	N	BSV
7440-22-4	Silver	0.062 J	4.9	mg/kg	SS-6: 0.33-2.33 ft BGS (12/20/2018)	10/11	0.068	4.9	39	N	N	BSV
7440-23-5	Sodium	65 J	2000 J	mg/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	9/11	120 - 210	2000 J	--		N	NAT
7440-28-0	**Thallium**	**0.085 J**	**0.51 J**	**mg/kg**	**SS-2: 0.2-2.2 ft BGS (11/9/2017)**	**11/11**	**--**	**0.51 J**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**15 J**	**42**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**42**	**39**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**59 J**	**4500 J**	**mg/kg**	**SS-6: 0.33-2.33 ft BGS (12/20/2018)**	**11/11**	**--**	**4500 J**	**2300**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	ug/kg	--	0/12	24 - 65	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	ug/kg	--	0/12	25 - 71	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	ug/kg	--	0/12	18 - 68	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	ug/kg	--	0/12	21 - 56	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	ug/kg	--	0/12	19 - 71	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**35 J**	**1700**	**ug/kg**	**SS-8: 0-2 ft BGS (12/20/2018)**	**9/12**	**15 - 38**	**1700**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	ug/kg	--	0/12	20 - 65	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	ug/kg	--	0/11	1.6 - 41	N/A	190	C	N	ND
72-55-9	4,4'-DDE	2.0 J	4.8 J	ug/kg	SS-7: 0-2 ft BGS (12/20/2018)	2/11	1.4 - 15	4.8 J	2000	C	N	BSV
50-29-3	4,4'-DDT	3.1 J	9.3 NJ	ug/kg	SS-7: 0-2 ft BGS (12/20/2018)	3/11	1.2 - 17	9.3 NJ	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	ug/kg	--	0/11	0.84 - 30	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	ug/kg	--	0/11	1 - 20	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	12	13	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	1/11	1.7 - 47	13	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	ug/kg	--	0/11	1.9 - 49	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	ug/kg	--	0/11	1.5 - 16	N/A	300	C	N	ND
60-57-1	Dieldrin	7.2 J	12 J	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	3/11	1 - 11	12 J	34	C	N	BSV
959-98-8	Endosulfan I	ND	ND	ug/kg	--	0/11	1.3 - 16	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	ug/kg	--	0/11	1.6 - 22	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	ug/kg	--	0/11	1.4 - 15	N/A	38000	N	N	ND

Table 2.27

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU17 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	2.6 NJ	2.6 NJ	ug/kg	SS-2: 0.2-2.2 ft BGS (11/9/2017)	1/11	1.6 - 17	2.6 NJ	1900	N	N	BSV
7421-93-4	Endrin aldehyde	1.7 NJ	3.0 J	ug/kg	SS-2: 0.2-2.2 ft BGS (11/9/2017)	2/11	1.4 - 22	3.0 J	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	ug/kg	--	0/11	0.97 - 14	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	ug/kg	--	0/11	2 - 36	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	1.4 NJ	12	ug/kg	SS-5: 0.33-2.33 ft BGS (12/20/2018)	2/11	1.4 - 19	12	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	ug/kg	--	0/11	0.88 - 11	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	2.1 J	3.5 NJ	ug/kg	SS-6: 0.33-2.33 ft BGS (12/20/2018)	2/11	1.6 - 30	3.5 NJ	70	C	N	BSV
72-43-5	Methoxychlor	1.6 NJ	19 NJ	ug/kg	SS-3: 0.3-2.3 ft BGS (11/9/2017)	3/11	7.2 - 46	19 NJ	32000	N	N	BSV
8001-35-2	Toxaphene	ND	ND	ug/kg	--	0/11	27 - 460	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	ug/kg	--	0/6	15 - 17	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	ug/kg	--	0/6	16 - 19	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	ug/kg	--	0/6	55 - 66	N/A	70000	N	N	ND
	Dioxins/Furans											
--	**Total TEQ (DL @ 0)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
--	**Total TEQ (DL @ Half)**	--	--	pg/g	--	--	--	--	4.8	C	Y	(6)
	Asbestos											
1332-21-4	Asbestos	ND	ND	%	--	0/5	0.25	N/A	--		N	ND
12001-29-5	Chrysotile asbestos	ND	ND	%	--	0/1	0.25	N/A	--		N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-1, SS-2, SS-4, SS-6, SS-7, SS-8, SS-9, SS-10, SS-11, SS-96, SS-97, SS-127, SS-128, SS-129, SS-174, SS-175, SS-176, SS-177, SS-178, TP-9, and TT-20.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.28

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	0.71 J	2.7 J	µg/kg	SS-20: 0-2 ft BGS (10/31/2017)	2/23	0.25 - 970	2.7 J	810000	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/17	0.28 - 970	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/20	0.42 - 970	N/A	150	N	N	ND
75-34-3	**1,1-Dichloroethane**	**560 J**	**560 J**	**µg/kg**	**BH75-13: 0-2 ft BGS (6/25/2013)**	**1/22**	**0.36 - 16**	**560 J**	**3.6**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/22	0.58 - 970	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/17	0.26 - 970	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/10	0.73 - 1900	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/13	0.38 - 970	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/17	0.24 - 970	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/22	0.31 - 970	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/22	0.33 - 970	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	1.9 J	1.9 J	µg/kg	SS-26: 0-2 ft BGS (10/26/2018)	1/18	0.31 - 970	1.9 J	180000 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/17	0.38 - 970	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	1 J	37 J	µg/kg	SS-34: 0-2 ft BGS (10/26/2018)	5/32	1.4 - 3900	37 J	2700000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/20	0.63 - 3900	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	36 J	36 J	µg/kg	S6(EPA): 0-1 ft BGS (10/23/1990)	1/30	0.96 - 3900	36 J	3300000	N	N	BSV
67-64-1	Acetone	3 J	25 J	µg/kg	S6(EPA): 0-1 ft BGS (10/23/1990)	2/32	3.3 - 6300	25 J	6100000	N	N	BSV
71-43-2	Benzene	0.86 J	200 J	µg/kg	BH75-13: 0-2 ft BGS (6/25/2013)	2/22	0.35 - 16	200 J	1200	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/22	0.36 - 970	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/20	0.43 - 970	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/22	0.64 - 970	N/A	680	N	N	ND
75-15-0	Carbon disulfide	4.1 J	4.1 J	µg/kg	SS-20: 0-2 ft BGS (10/31/2017)	1/23	0.23 - 970	4.1 J	77000	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/22	0.27 - 970	N/A	650	C	N	ND
108-90-7	Chlorobenzene	630 J	630 J	µg/kg	BH75-13: 0-2 ft BGS (6/25/2013)	1/20	0.36 - 16	630 J	28000	N	N	BSV
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/22	0.41 - 970	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/22	0.25 - 970	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/22	0.41 - 970	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/15	0.3 - 970	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/22	0.28 - 970	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/15	0.23 - 1900	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/20	0.32 - 970	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/14	0.38 - 4.8	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	1400	1400	µg/kg	BH75-13: 0-2 ft BGS (6/25/2013)	1/20	0.29 - 16	1400	5800	C	N	BSV
98-82-8	Isopropyl benzene	790 J	790 J	µg/kg	BH75-13: 0-2 ft BGS (6/25/2013)	1/13	0.22 - 4.8	790 J	190000	N	N	BSV
79-20-9	Methyl acetate	110 J	110 J	µg/kg	BH75-13: 0-2 ft BGS (6/25/2013)	1/15	1.3 - 9.6	110 J	7800000	N	N	BSV
108-87-2	Methyl cyclohexane	530 J	530 J	µg/kg	BH75-13: 0-2 ft BGS (6/25/2013)	1/15	0.25 - 9.6	530 J	650000 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/15	0.29 - 970	N/A	47000	C	N	ND
75-09-2	Methylene chloride	4.1 J	55 J	µg/kg	SS-26: 0-2 ft BGS (10/26/2018)	2/24	0.26 - 3100	55 J	35000	N	N	BSV
100-42-5	Styrene	0.90 J	0.90 J	µg/kg	SS-24: 0-2 ft BGS (11/7/2017)	1/20	0.29 - 970	0.90 J	600000	N	N	BSV
127-18-4	Tetrachloroethene	1.1 J	260 J	µg/kg	SS-20: 0-2 ft BGS (10/31/2017)	5/32	0.4 - 970	260 J	8100	N	N	BSV
108-88-3	Toluene	1.3 J	1500	µg/kg	BH75-13: 0-2 ft BGS (6/25/2013)	11/31	0.37 - 16	1500	490000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/15	0.41 - 970	N/A	160000	N	N	ND

Table 2.28

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/20	0.23 - 970	N/A	1800	C	N	ND
79-01-6	Trichloroethene	3.5 J	130 J	µg/kg	BH75-13: 0-2 ft BGS (6/25/2013)	4/34	0.44 - 16	130 J	410	N	N	BSV
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/15	0.26 - 970	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/15	0.53 - 970	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/22	0.3 - 970	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	3 J	8100	µg/kg	BH75-13: 0-2 ft BGS (6/25/2013)	2/30	0.43 - 16	8100	58000	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/16	10 - 150	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/23	27 - 1300	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/23	9.7 - 950	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/23	22 - 650	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/23	22 - 590	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/22	23 - 2100	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/23	19 - 920	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/23	23 - 830	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/23	0.49 - 530	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/23	8.9 - 530	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	4.1 J	1900	µg/kg	SS-26: 0-2 ft BGS (10/26/2018)	27/33	7.3 - 530	1900	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/23	12 - 530	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/23	9.9 - 1300	N/A	63000	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/23	9 - 530	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	71 J	130 J	µg/kg	SS-22: 0-2 ft BGS (11/7/2017)	2/15	22 - 430	130 J	320000 (5)	N	N	BSV
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/15	20 - 640	N/A	1200	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/22	17 - 1300	N/A	--		N	ND
106-44-5	4-Methylphenol	ND	ND	µg/kg	--	0/8	220 - 530	N/A	630000	N	N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/22	10 - 1300	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/23	14 - 530	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/23	23 - 670	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/22	19 - 530	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/23	14 - 530	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/22	28 - 1300	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/23	19 - 1400	N/A	--		N	ND
83-32-9	Acenaphthene	11	1200	µg/kg	S6(EPA): 0-1 ft BGS (10/23/1990)	13/33	0.83 - 530	1200	360000	N	N	BSV
208-96-8	Acenaphthylene	7.7 J	1100	µg/kg	SS-33: 0.17-2.17 ft BGS (10/26/2018)	10/23	0.39 - 530	1100	360000 (5)	N	N	BSV
98-86-2	Acetophenone	38 J	550 J	µg/kg	SS-22: 0-2 ft BGS (11/7/2017)	9/16	10 - 160	550 J	780000	N	N	BSV
120-12-7	Anthracene	4.6 J	3000	µg/kg	S6(EPA): 0-1 ft BGS (10/23/1990)	22/33	7.3 - 530	3000	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/16	9.9 - 530	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	16 J	420 J	µg/kg	SS-22: 0-2 ft BGS (11/7/2017)	8/16	13 - 340	420 J	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**11 J**	**8500**	**µg/kg**	**S3(EPA): 0-1 ft BGS (10/23/1990)**	**27/33**	**330 - 530**	**8500**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**14 J**	**6000**	**µg/kg**	**SS-33: 0.17-2.17 ft BGS (10/26/2018)**	**25/33**	**10 - 530**	**6000**	**110**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**12 J**	**9500**	**µg/kg**	**S3(EPA): 0-1 ft BGS (10/23/1990)**	**28/33**	**330 - 530**	**9500**	**1100**	**C**	**Y**	**ASV**

Table 2.28

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	10 J	4700	µg/kg	S3(EPA): 0-1 ft BGS (10/23/1990)	23/33	7.9 - 530	4700	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	12	6400	µg/kg	S3(EPA): 0-1 ft BGS (10/23/1990)	21/33	7.7 - 530	6400	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	49 J	180 J	µg/kg	SS-22: 0-2 ft BGS (11/7/2017)	8/16	3.8 - 250	180 J	4700	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/23	13 - 530	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/23	2.2 - 530	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	33 J	2100	µg/kg	S09(OEPA): 0.3-0.5 ft BGS (7/9/1996)	15/33	38 - 760	2100	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	25 J	18000 E	µg/kg	S09(OEPA): 0.3-0.5 ft BGS (7/9/1996)	9/33	11 - 530	18000 E	290000	C	N	BSV
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/16	40 - 1100	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**30 J**	**870**	**µg/kg**	**SS-33: 0.17-2.17 ft BGS (10/26/2018)**	**7/23**	**21 - 530**	**870**	**--**		**Y**	**AD**
218-01-9	Chrysene	14 J	6700	µg/kg	SS-33: 0.17-2.17 ft BGS (10/26/2018)	29/33	330 - 530	6700	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**50**	**1600**	**µg/kg**	**S6(EPA): 0-1 ft BGS (10/23/1990)**	**11/33**	**0.72 - 530**	**1600**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	10 J	830 J	µg/kg	S3(EPA): 0-1 ft BGS (10/23/1990)	18/33	0.72 - 530	830 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	140 J	140 J	µg/kg	SS-22: 0-2 ft BGS (11/7/2017)	1/23	17 - 530	140 J	5100000	N	N	BSV
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/23	16 - 530	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	18 J	1500	µg/kg	S09(OEPA): 0.3-0.5 ft BGS (7/9/1996)	13/33	17 - 410	1500	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	23 J	23 J	µg/kg	S02(OEPA): 0-0.1 ft BGS (7/9/1996)	1/23	8.6 - 530	23 J	63000	N	N	BSV
206-44-0	Fluoranthene	14 J	21000 D	µg/kg	S6(EPA): 0-1 ft BGS (10/23/1990)	30/33	330 - 530	21000 D	240000	N	N	BSV
86-73-7	Fluorene	4.4 J	1500	µg/kg	S3(EPA): 0-1 ft BGS (10/23/1990)	13/33	0.58 - 530	1500	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/23	2.3 - 530	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/23	6.1 - 530	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/22	8.8 - 920	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/23	9.8 - 530	N/A	1800	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**18**	**5000**	**µg/kg**	**S3(EPA): 0-1 ft BGS (10/23/1990)**	**23/33**	**8.2 - 530**	**5000**	**1100**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/23	13 - 530	N/A	570000	C	N	ND
91-20-3	Naphthalene	11	1400	µg/kg	SS-26: 0-2 ft BGS (10/26/2018)	26/33	0.92 - 530	1400	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/23	2.4 - 530	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/23	6.9 - 530	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	450 J	450 J	µg/kg	S3(EPA): 0-1 ft BGS (10/23/1990)	1/33	13 - 530	450 J	110000	C	N	BSV
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/23	9.9 - 1300	N/A	1000	C	N	ND
85-01-8	Phenanthrene	18	16000 D	µg/kg	S3(EPA): 0-1 ft BGS (10/23/1990)	30/33	330 - 530	16000 D	180000 (5)	N	N	BSV
108-95-2	Phenol	46 J	220 J	µg/kg	SS-22: 0-2 ft BGS (11/7/2017)	4/23	8 - 530	220 J	1900000	N	N	BSV
129-00-0	Pyrene	14 J	13000	µg/kg	S6(EPA): 0-1 ft BGS (10/23/1990)	30/33	330 - 1300	13000	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**1140**	**12000**	**mg/kg**	**SS-22: 0-2 ft BGS (11/7/2017)**	**33/33**	**--**	**12000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.21 J**	**52**	**mg/kg**	**SS-22: 0-2 ft BGS (11/7/2017)**	**22/33**	**0.17 - 6.6**	**52**	**3.1**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**1.6 B**	**77.2**	**mg/kg**	**S02(OEPA): 0-0.1 ft BGS (7/9/1996)**	**33/33**	**1.2**	**77.2**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	6.3	991	mg/kg	S1(EPA): 1-2 ft BGS (10/23/1990)	33/33	--	991	1500	N	N	BSV
7440-41-7	Beryllium	0.061 J	5.8	mg/kg	SS-26: 0-2 ft BGS (10/26/2018)	31/33	0.25 - 1	5.8	16	N	N	BSV
7440-43-9	**Cadmium**	**0.13 J**	**34**	**mg/kg**	**SS-22: 0-2 ft BGS (11/7/2017)**	**27/33**	**0.17 - 1**	**34**	**7.1**	**N**	**Y**	**ASV**
7440-70-2	Calcium	590	110000	mg/kg	SS-31: 0-2 ft BGS (11/2/2017)	33/33	--	110000	--		N	NAT
16065-83-1	Chromium III (trivalent)	5.4	94.3	mg/kg	SS-22: 0-2 ft BGS (11/7/2017)	34/34	--	94.3	12000	N	N	BSV

Table 2.28

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
18540-29-9	**Chromium VI (hexavalent)**	**0.56 J**	**15.7**	**mg/kg**	**SS-22: 0-2 ft BGS (11/7/2017)**	**28/34**	**0.28 - 2.5**	**15.7**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**1.4 B**	**22.1**	**mg/kg**	**S9(EPA): 0-1 ft BGS (10/23/1990)**	**32/33**	**10**	**22.1**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**15.8**	**191000**	**mg/kg**	**S10(OEPA): 0-0.3 ft BGS (7/9/1996)**	**33/33**	**--**	**191000**	**310**	**N**	**Y**	**ASV**
57-12-5	**Cyanide (total)**	**0.26 B**	**3.7**	**mg/kg**	**S09(OEPA): 0.3-0.5 ft BGS (7/9/1996)**	**10/23**	**0.19 - 0.68**	**3.7**	**2.3**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**2840**	**94000**	**mg/kg**	**SS-22: 0-2 ft BGS (11/7/2017)**	**33/33**	**--**	**94000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**6.4**	**13000**	**mg/kg**	**SS-22: 0-2 ft BGS (11/7/2017)**	**33/33**	**--**	**13000**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - coarse fraction**	**48**	**6400**	**mg/kg**	**SS-22: 0-2 ft BGS (11/7/2017)**	**5/5**	**--**	**6400**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - fine fraction**	**120**	**4200**	**mg/kg**	**SS-22: 0-2 ft BGS (11/7/2017)**	**5/5**	**--**	**4200**	**400**	**C**	**Y**	**ASV**
7439-92-1	**Lead - total (calculated by fine/coarse fraction)**	**70**	**5900**	**mg/kg**	**SS-22: 0-2 ft BGS (11/7/2017)**	**5/5**	**--**	**5900**	**400**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	294 B	42000	mg/kg	SS-36: 0-2 ft BGS (10/31/2017)	33/33	--	42000	--		N	NAT
7439-96-5	**Manganese**	**7.2**	**1400**	**mg/kg**	**SS-28: 0-2 ft BGS (10/26/2018)**	**33/33**	**--**	**1400**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.045 J	0.48	mg/kg	S02(OEPA): 0-0.1 ft BGS (7/9/1996)	18/33	0.008 - 0.17	0.48	1.1	N	N	BSV
7440-02-0	**Nickel**	**7.3**	**402**	**mg/kg**	**S8(EPA): 0-1 ft BGS (10/23/1990)**	**33/33**	**--**	**402**	**150**	**N**	**Y**	**ASV**
7440-09-7	Potassium	81 J	1630 B	mg/kg	S9(EPA): 0-1 ft BGS (10/23/1990)	33/33	--	1630 B	--		N	NAT
7782-49-2	Selenium	0.23 J	8.8	mg/kg	S02(OEPA): 0-0.1 ft BGS (7/9/1996)	28/33	0.82 - 27.5	8.8	39	N	N	BSV
7440-22-4	Silver	0.041 J	7.6	mg/kg	S10(OEPA): 0-0.3 ft BGS (7/9/1996)	17/33	0.21 - 2	7.6	39	N	N	BSV
7440-23-5	Sodium	43.7 B	980	mg/kg	SS-22: 0-2 ft BGS (11/7/2017)	25/33	59 - 550	980	--		N	NAT
7440-28-0	**Thallium**	**0.10 J**	**4.5**	**mg/kg**	**S10(OEPA): 0-0.3 ft BGS (7/9/1996)**	**22/33**	**0.039 - 2**	**4.5**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**0.62 B**	**92.6**	**mg/kg**	**S02(OEPA): 0-0.1 ft BGS (7/9/1996)**	**33/33**	**--**	**92.6**	**39**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**9.2**	**11500**	**mg/kg**	**S10(OEPA): 0-0.3 ft BGS (7/9/1996)**	**33/33**	**--**	**11500**	**2300**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/23	24 - 580	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/23	26 - 550	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/23	18 - 390	N/A	170	C	N	ND
53469-21-9	**Aroclor-1242 (PCB-1242)**	**340**	**770**	**µg/kg**	**SS-21: 0-2 ft BGS (11/19/2018)**	**2/23**	**21 - 480**	**770**	**230**	**C**	**Y**	**ASV**
12672-29-6	**Aroclor-1248 (PCB-1248)**	**360 X**	**4200 X**	**µg/kg**	**S2(EPA): 0-1 ft BGS (10/23/1990)**	**3/33**	**19 - 410**	**4200 X**	**230**	**C**	**Y**	**ASV**
11097-69-1	**Aroclor-1254 (PCB-1254)**	**28 J**	**29000**	**µg/kg**	**SS-24: 0-2 ft BGS (11/7/2017)**	**13/23**	**16 - 53**	**29000**	**120**	**C**	**Y**	**ASV**
11096-82-5	**Aroclor-1260 (PCB-1260)**	**23 J**	**2800 X**	**µg/kg**	**S2(EPA): 0-1 ft BGS (10/23/1990)**	**9/33**	**20 - 430**	**2800 X**	**240**	**C**	**Y**	**ASV**
	Pesticides											
72-54-8	4,4'-DDD	4.4	28 J	µg/kg	SS-23: 0-2 ft BGS (11/19/2018)	2/23	1.8 - 200	28 J	190	C	N	BSV
72-55-9	4,4'-DDE	2.6 J	2.6 J	µg/kg	S04(OEPA): 1.5-2 ft BGS (7/9/1996)	1/23	1.3 - 110	2.6 J	2000	C	N	BSV
50-29-3	4,4'-DDT	3.4 J	3.8 J	µg/kg	SS-36: 0-2 ft BGS (10/31/2017)	2/23	1.4 - 84	3.8 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/23	0.95 - 140	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/23	1.1 - 96	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	5.4 P	5.4 P	µg/kg	S04(OEPA): 1.5-2 ft BGS (7/9/1996)	1/23	1.8 - 230	5.4 P	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/23	1.8 - 230	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/23	1.4 - 120	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/23	0.98 - 80	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/23	1.4 - 88	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	4.0 J	4.0 J	µg/kg	SS-34: 0-2 ft BGS (10/26/2018)	1/23	1.8 - 110	4.0 J	47000	N	N	BSV
1031-07-8	Endosulfan sulfate	1.7 J	1.7 J	µg/kg	SS-35: 0-2 ft BGS (10/30/2017)	1/23	1.3 - 94	1.7 J	38000	N	N	BSV

Table 2.28

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	2.3 PJ	140 NJ	µg/kg	SS-24: 0-2 ft BGS (11/7/2017)	3/23	1.5 - 140	140 NJ	1900	N	N	BSV
7421-93-4	Endrin aldehyde	6.6 P	110 J	µg/kg	SS-22: 0-2 ft BGS (11/7/2017)	2/23	2 - 110	110 J	1900	N	N	BSV
53494-70-5	Endrin ketone	7.5 P	7.5 P	µg/kg	S11(OEPA): 0.2-0.3 ft BGS (7/9/1996)	1/23	1.1 - 66	7.5 P	1900	N	N	BSV
58-89-9	gamma-BHC (lindane)	0.42 J	0.77 PJ	µg/kg	S10(OEPA): 0-0.3 ft BGS (7/9/1996)	2/23	1.8 - 170	0.77 PJ	570	C	N	BSV
5103-74-2	gamma-Chlordane	0.35 PJ	4.3	µg/kg	S04(OEPA): 1.5-2 ft BGS (7/9/1996)	4/23	1.5 - 90	4.3	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/23	0.85 - 120	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	0.49 PJ	0.78 PJ	µg/kg	S04(OEPA): 1.5-2 ft BGS (7/9/1996)	2/23	1.8 - 140	0.78 PJ	70	C	N	BSV
72-43-5	Methoxychlor	1.8 PJ	2.8 J	µg/kg	SS-30: 0-2 ft BGS (11/2/2017)	2/23	1.3 - 480	2.8 J	32000	N	N	BSV
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/23	31 - 2200	N/A	490	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/7	14 - 21	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/8	15 - 23	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/8	51 - 88	N/A	70000	N	N	ND
	Dioxins/Furans											
39001-02-0	1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	14	14	pg/g	SS-35: 0-2 ft BGS (10/30/2017)	1/6	7.7 - 38	14	--			Refer to Total TEQ
3268-87-9	1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	41 J	6200 J	pg/g	SS-33: 0.17-2.17 ft BGS (10/26/2018)	6/6	--	6200 J	--			Refer to Total TEQ
67562-39-4	1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	8.4	57	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	2/6	2.3 - 9.6	57	--			Refer to Total TEQ
35822-46-9	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	7.3	62	pg/g	SS-33: 0.17-2.17 ft BGS (10/26/2018)	6/6	--	62	--			Refer to Total TEQ
55673-89-7	1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	1.8 J	1.8 J	pg/g	SS-28: 0-2 ft BGS (10/26/2018)	1/6	0.13 - 1.6	1.8 J	--			Refer to Total TEQ
70648-26-9	1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	1.2 J	7.5 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	4/6	0.22 - 0.93	7.5 J	--			Refer to Total TEQ
39227-28-6	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.55 J	11	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	3/6	0.055 - 1.8	11	--			Refer to Total TEQ
57117-44-9	1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.7 J	5.6 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	4/6	0.23 - 0.83	5.6 J	--			Refer to Total TEQ
57653-85-7	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	0.99 J	17 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	4/6	0.061 - 1.8	17 J	--			Refer to Total TEQ
72918-21-9	1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	ND	ND	pg/g	--	0/6	0.2 - 1.2	N/A	--			Refer to Total TEQ
19408-74-3	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	0.98 J	18 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	4/6	0.053 - 1.6	18 J	--			Refer to Total TEQ
57117-41-6	1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	0.28 J	3.1 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	2/6	0.12 - 0.36	3.1 J	--			Refer to Total TEQ
40321-76-4	1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	0.79 J	10 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	2/6	0.12 - 0.92	10 J	--			Refer to Total TEQ
60851-34-5	2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	1.1 J	4.2 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	3/6	0.21 - 1	4.2 J	--			Refer to Total TEQ
57117-31-4	2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	0.90 J	3.9 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	4/6	0.11 - 0.14	3.9 J	--			Refer to Total TEQ
51207-31-9	2,3,7,8-Tetrachlorodibenzofuran (TCDF)	0.89 J	1.8	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	4/6	0.29 - 0.95	1.8	--			Refer to Total TEQ
1746-01-6	2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.17 J	0.17 J	pg/g	SS-35: 0-2 ft BGS (10/30/2017)	1/6	0.38 - 1	0.17 J	--			Refer to Total TEQ
38998-75-3	Total heptachlorodibenzofuran (HpCDF)	4.0 J	94 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	6/6	--	94 J	--			Refer to Total TEQ
37871-00-4	Total heptachlorodibenzo-p-dioxin (HpCDD)	13 J	130 J	pg/g	SS-33: 0.17-2.17 ft BGS (10/26/2018)	6/6	--	130 J	--			Refer to Total TEQ
55684-94-1	Total hexachlorodibenzofuran (HxCDF)	1.4 J	47 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	6/6	--	47 J	--			Refer to Total TEQ
34465-46-8	Total hexachlorodibenzo-p-dioxin (HxCDD)	2.9 J	94 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	5/6	1.8	94 J	--			Refer to Total TEQ
30402-15-4	Total pentachlorodibenzofuran (PeCDF)	8.0 J	54 J	pg/g	SS-35: 0-2 ft BGS (10/30/2017)	5/6	0.12	54 J	--			Refer to Total TEQ
36088-22-9	Total pentachlorodibenzo-p-dioxin (PeCDD)	0.53 J	58 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	5/6	0.92	58 J	--			Refer to Total TEQ
55722-27-5	Total tetrachlorodibenzofuran (TCDF)	5.4 J	130 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	5/6	0.29	130 J	--			Refer to Total TEQ
41903-57-5	Total tetrachlorodibenzo-p-dioxin (TCDD)	2.0 J	10 J	pg/g	SS-26: 0-2 ft BGS (10/26/2018)	3/6	0.39 - 1	10 J	--			Refer to Total TEQ
--	**Total TEQ (DL @ 0)**	**0.0889**	**18.859**	**pg/g**	**SS-26: 0-2 ft BGS (10/26/2018)**	**6/6**	**--**	**18.859**	**4.8**	**C**	**Y**	**(6)**
--	**Total TEQ (DL @ Half)**	**0.463355**	**19.21035**	**pg/g**	**SS-26: 0-2 ft BGS (10/26/2018)**	**6/6**	**--**	**19.21035**	**4.8**	**C**	**Y**	**(6)**

Table 2.28

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)	COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Asbestos										
1332-21-4	Asbestos	ND	ND	%	--	0/3	0.25	N/A	--	N	ND
12001-29-5	**Chrysotile asbestos**	**0.25**	**0.5**	**%**	**SS-188-AS: 0-0.5 ft BGS (10/16/2018)**	**3/11**	**0.25**	**0.5**	**--**	**Y**	**AD**

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: S1, S2, S3, S4, S5, S6, S7, S8, S9, S11, S01, S02, S03, S04, S06, S09, S10, S11, SS-20, SS-21, SS-22, SS-23, SS-24, SS-26, SS-27, SS-28, SS-29,SS-30, SS-31, SS-33, SS-34, SS-35, SS-36, SS-105, SS-106, SS-107, SS-108, SS-110, SS-111, SS-113, SS-179-AS, SS-180-AS, SS-181-AS, SS-182-AS, SS-183-AS, SS-184-AS, SS-185-AS, SS-186-AS, SS-187-AS, SS-188-AS, SS-189-AS, SS-190-AS, SS-191-AS, SS-192-AS, BH75-13, BH166-17, TP-2.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) Due to limited sampling for dioxins/furans in each exposure unit (EU), evaluation of the dioxins/furans will be evaluated using Site-wide data.

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.
E - Exceed calibration range of GC/MS instrument (Organics).
D - Compounds at secondary dilution factor.
B - Estimated concentration (Inorganics).
X - Unknown description
P - The %RPD between the primary and confirmation column/ detector is >40%. The lower value has been reported.

Table 2.29

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU3-EU4 Soil Vapor (Jim City)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU3-EU4 Soil Vapor (Jim City)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	0.93 J	0.93 J	µg/m^3	GP08-09 (9/17/2009)	1/4	0.16 - 3700	0.93 J	17400	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/m^3	--	0/4	0.42 - 9500	N/A	2	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/m^3	--	0/4	0.28 - 6700	N/A	1	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/m^3	--	0/4	0.11 - 2400	N/A	59	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/m^3	--	0/4	0.13 - 3000	N/A	695	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/m^3	--	0/4	0.73 - 16000	N/A	7	N	N	ND
95-63-6	**1,2,4-Trimethylbenzene**	**13**	**8400 J**	**µg/m^3**	**GP07-18 (8/21/2018)**	**2/2**	**--**	**8400 J**	**209**	**N**	**Y**	**ASV**
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/m^3	--	0/2	9.7 - 490	N/A	0.00563	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/m^3	--	0/4	0.34 - 7600	N/A	0.2	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/m^3	--	0/4	0.42 - 9500	N/A	695	N	N	ND
107-06-2	1,2-Dichloroethane	0.88	0.88	µg/m^3	GP08-19 (10/8/2019)	1/4	0.81 - 4300	0.88	4	C	N	BSV
78-87-5	1,2-Dichloropropane	ND	ND	µg/m^3	--	0/4	0.24 - 5400	N/A	14	N	N	ND
76-14-2	1,2-Dichlorotetrafluoroethane (CFC 114)	0.70 J	0.70 J	µg/m^3	GP08-19 (10/8/2019)	1/2	5100	0.70 J	348 (5)	N	N	BSV
108-67-8	1,3,5-Trimethylbenzene	4.1 J	4.1 J	µg/m^3	GP08-19 (10/8/2019)	1/2	7200	4.1 J	209	N	N	BSV
106-99-0	1,3-Butadiene	ND	ND	µg/m^3	--	0/2	0.14 - 3200	N/A	3	C	N	ND
541-73-1	1,3-Dichlorobenzene	2.0 J	2.0 J	µg/m^3	GP08-09 (9/17/2009)	1/4	0.39 - 8800	2.0 J	695 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/m^3	--	0/4	0.38 - 8700	N/A	9	C	N	ND
123-91-1	1,4-Dioxane	ND	ND	µg/m^3	--	0/2	0.29 - 6500	N/A	19	C	N	ND
540-84-1	2,2,4-Trimethylpentane	96	1800000	µg/m^3	GP07-18 (8/21/2018)	2/2	--	1800000	--		N	NTX
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	1.9 J	2.3 J	µg/m^3	GP08-19 (10/8/2019)	2/4	150 - 13000	2.3 J	17400	N	N	BSV
95-49-8	2-Chlorotoluene	ND	ND	µg/m^3	--	0/2	0.33 - 7400	N/A	--		N	NTX
591-78-6	2-Hexanone	ND	ND	µg/m^3	--	0/4	0.24 - 5400	N/A	104	N	N	ND
135-98-8	2-Phenylbutane (sec-Butylbenzene)	ND	ND	µg/m^3	--	0/2	0.35 - 7900	N/A	--		N	NTX
622-96-8	4-Ethyl toluene	4.1	4.1	µg/m^3	GP08-19 (10/8/2019)	1/2	7300	4.1	--		N	NTX
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/m^3	--	0/4	0.8 - 18000	N/A	10400	N	N	ND
67-64-1	Acetone	15 J	15 J	µg/m^3	GP08-19 (10/8/2019)	1/4	17 - 75000	15 J	107000	N	N	BSV
107-05-1	Allyl chloride	ND	ND	µg/m^3	--	0/2	0.15 - 3400	N/A	3	N	N	ND
71-43-2	**Benzene**	**1.8**	**110000**	**µg/m^3**	**GP07-18 (8/21/2018)**	**3/4**	**49**	**110000**	**12**	**C**	**Y**	**ASV**
100-44-7	Benzyl chloride	ND	ND	µg/m^3	--	0/2	0.4 - 9100	N/A	2	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/m^3	--	0/4	0.29 - 6700	N/A	3	C	N	ND
75-25-2	Bromoform	ND	ND	µg/m^3	--	0/4	0.5 - 11000	N/A	85	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/m^3	--	0/4	0.12 - 2800	N/A	17	N	N	ND
106-97-8	Butane	15	6200 J	µg/m^3	GP07-18 (8/21/2018)	2/2	--	6200 J	--		N	NTX
75-15-0	Carbon disulfide	5.9	8.4	µg/m^3	GP08-09 (9/17/2009)	2/4	160 - 2200	8.4	2430	N	N	BSV

Table 2.29

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU3-EU4 Soil Vapor (Jim City)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU3-EU4 Soil Vapor (Jim City)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
56-23-5	Carbon tetrachloride	0.32 J	0.32 J	µg/m^3	GP08-19 (10/8/2019)	1/4	1.9 - 5400	0.32 J	16	C	N	BSV
108-90-7	Chlorobenzene	ND	ND	µg/m^3	--	0/4	0.23 - 5100	N/A	174	N	N	ND
75-45-6	Chlorodifluoromethane	ND	ND	µg/m^3	--	0/2	0.13 - 3000	N/A	174000	N	N	ND
75-00-3	Chloroethane	0.24 J	0.24 J	µg/m^3	GP08-19 (10/8/2019)	1/4	1.1 - 2100	0.24 J	34800	N	N	BSV
67-66-3	Chloroform (Trichloromethane)	0.55 J	1.2 J	µg/m^3	GP08-09 (9/17/2009)	2/4	49 - 4200	1.2 J	4	C	N	BSV
74-87-3	Chloromethane (Methyl chloride)	1.1 J	1.1 J	µg/m^3	GP08-19 (10/8/2019)	1/4	1.7 - 7500	1.1 J	313	N	N	BSV
156-59-2	cis-1,2-Dichloroethene	0.51 J	0.51 J	µg/m^3	GP08-19 (10/8/2019)	1/4	0.79 - 5400	0.51 J	--		N	NTX
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/4	0.34 - 7600	N/A	23	C	N	ND
110-82-7	**Cyclohexane**	**2.1**	**230000**	**µg/m^3**	**GP07-18 (8/21/2018)**	**3/4**	**35**	**230000**	**20900**	**N**	**Y**	**ASV**
99-87-6	Cymene (p-Isopropyltoluene)	ND	ND	µg/m^3	--	0/2	0.31 - 7100	N/A	--		N	NTX
124-48-1	Dibromochloromethane	ND	ND	µg/m^3	--	0/4	0.36 - 8100	N/A	--		N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	13	63	µg/m^3	GP08-09 (9/17/2009)	2/4	75 - 7600	63	348	N	N	BSV
100-41-4	**Ethylbenzene**	**4.4**	**140000**	**µg/m^3**	**GP07-18 (8/21/2018)**	**3/4**	**44**	**140000**	**37**	**C**	**Y**	**ASV**
87-68-3	Hexachlorobutadiene	ND	ND	µg/m^3	--	0/2	0.83 - 19000	N/A	4	C	N	ND
110-54-3	**Hexane**	**42**	**630000**	**µg/m^3**	**GP07-18 (8/21/2018)**	**2/2**	**--**	**630000**	**2430**	**N**	**Y**	**ASV**
67-63-0	Isopropyl alcohol	1.5 J	1.5 J	µg/m^3	GP08-19 (10/8/2019)	1/2	5200	1.5 J	695	N	N	BSV
98-82-8	**Isopropyl benzene (Cumene)**	**1.3 J**	**9800 J**	**µg/m^3**	**GP07-18 (8/21/2018)**	**2/4**	**2.5 - 50**	**9800 J**	**1390**	**N**	**Y**	**ASV**
80-62-6	Methyl methacrylate	ND	ND	µg/m^3	--	0/2	0.32 - 7300	N/A	2430	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/m^3	--	0/4	0.61 - 14000	N/A	360	C	N	ND
75-09-2	Methylene chloride	0.55 J	19 J	µg/m^3	GP07-09 (9/16/2009)	3/4	25000	19 J	2090	N	N	BSV
91-20-3	Naphthalene	0.57 J	0.57 J	µg/m^3	GP08-19 (10/8/2019)	1/4	2.6 - 11000	0.57 J	3	C	N	BSV
104-51-8	N-Butylbenzene	0.90 J	0.90 J	µg/m^3	GP08-19 (10/8/2019)	1/2	5700	0.90 J	--		N	NTX
142-82-5	**N-Heptane**	**32**	**1100000**	**µg/m^3**	**GP07-18 (8/21/2018)**	**2/2**	**--**	**1100000**	**1390**	**N**	**Y**	**ASV**
103-65-1	N-Propylbenzene	2.8	2.8	µg/m^3	GP08-19 (10/8/2019)	1/2	6200	2.8	3480	N	N	BSV
100-42-5	Styrene	ND	ND	µg/m^3	--	0/4	0.25 - 5600	N/A	3480	N	N	ND
75-65-0	tert-Butyl alcohol	0.46 J	0.46 J	µg/m^3	GP08-19 (10/8/2019)	1/2	2600	0.46 J	104000 (5)	N	N	BSV
98-06-6	tert-Butylbenzene	ND	ND	µg/m^3	--	0/2	0.36 - 8200	N/A	--		N	NTX
127-18-4	Tetrachloroethene	1.8	25	µg/m^3	GP08-09 (9/17/2009)	2/4	69 - 6100	25	139	N	N	BSV
109-99-9	Tetrahydrofuran	ND	ND	µg/m^3	--	0/2	0.19 - 4200	N/A	6950	N	N	ND
108-88-3	**Toluene**	**22**	**1700000**	**µg/m^3**	**GP07-18 (8/21/2018)**	**4/4**	**--**	**1700000**	**17400**	**N**	**Y**	**ASV**
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/m^3	--	0/4	0.2 - 4500	N/A	--		N	NTX
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/4	0.22 - 4900	N/A	23	C	N	ND
79-01-6	Trichloroethene	0.46 J	1.6 J	µg/m^3	GP08-09 (9/17/2009)	2/4	54 - 4400	1.6 J	7	N	N	BSV

Table 2.29

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU3-EU4 Soil Vapor (Jim City)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU3-EU4 Soil Vapor (Jim City)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
75-69-4	Trichlorofluoromethane (CFC-11)	1.6	74	µg/m^3	GP08-09 (9/17/2009)	3/4	3100	74	17400 (5)	N	N	BSV
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/m^3	--	0/4	0.24 - 5400	N/A	17400	N	N	ND
593-60-2	Vinyl bromide (Bromoethene)	ND	ND	µg/m^3	--	0/2	0.15 - 3500	N/A	3	C	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/m^3	--	0/4	0.18 - 4100	N/A	6	C	N	ND
1330-20-7	**Xylenes (total)**	**13**	**770000**	**µg/m^3**	**GP07-18 (8/21/2018)**	**3/4**	**44**	**770000**	**348**	**N**	**Y**	**ASV**

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: GP07-18, GP08-19, GP07-09, GP08-09.

(3) USEPA Vapor Intrusion Screening Levels (VISL), Resident, Target Sub-Slab and Near-source Soil Gas Concentration (Risk = 1E-06, HI = 0.1), November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Deletion Reason: Maximum detected below Screening Value (BSV)
Not Detected (ND)
No Toxicity Information or Appropriate Surrogate available (NTX)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,2-dichlorotetrafluoroethane (CFC 114)	-	dichlorodifluoromethane (CFC-12)
1,3-dichlorobenzene	-	1,2-dichlorobenzene
tert-butyl alcohol	-	sec-butyl alcohol
trichlorofluoromethane (CFC-11)	-	trifluorotrichloroethane (CFC-113)

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.30

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU5-EU8 Soil Vapor (Barnett)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU5-EU8 Soil Vapor (Barnett)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	4.1 J	4.5	µg/m^3	GP10-09 (8/21/2018)	2/2	--	4.5	17400	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/m^3	--	0/2	1 - 4.2	N/A	2	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/m^3	--	0/2	0.74 - 2.9	N/A	1	N	N	ND
75-34-3	1,1-Dichloroethane	2.9	2.9	µg/m^3	GP10-09 (8/21/2018)	1/2	1.1	2.9	59	C	N	BSV
75-35-4	1,1-Dichloroethene	ND	ND	µg/m^3	--	0/2	0.34 - 1.3	N/A	695	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/m^3	--	0/2	1.8 - 7.3	N/A	7	N	N	ND
95-63-6	1,2,4-Trimethylbenzene	11	12	µg/m^3	GP09-09 (8/21/2018)	2/2	--	12	209	N	N	BSV
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/m^3	--	0/2	0.85 - 3.4	N/A	0.2	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/m^3	--	0/2	1.1 - 4.2	N/A	695	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/m^3	--	0/2	0.48 - 1.9	N/A	4	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/m^3	--	0/2	0.6 - 2.4	N/A	14	N	N	ND
76-14-2	1,2-Dichlorotetrafluoroethane (CFC 114)	0.99 J	0.99 J	µg/m^3	GP10-09 (8/21/2018)	1/2	2.2	0.99	348 (5)	N	N	BSV
108-67-8	1,3,5-Trimethylbenzene	2.9	4.5 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	4.5	209	N	N	BSV
106-99-0	1,3-Butadiene	ND	ND	µg/m^3	--	0/2	0.35 - 1.4	N/A	3	C	N	ND
541-73-1	1,3-Dichlorobenzene	4.2	4.2	µg/m^3	GP10-09 (8/21/2018)	1/2	3.9	4.2	695 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/m^3	--	0/2	0.96 - 3.8	N/A	9	C	N	ND
123-91-1	1,4-Dioxane	ND	ND	µg/m^3	--	0/2	0.72 - 2.9	N/A	19	C	N	ND
540-84-1	2,2,4-Trimethylpentane	2.1 J	20 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	20	--		N	NTX
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	12	13 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	13	17400	N	N	BSV
95-49-8	2-Chlorotoluene	1.5 J	1.5 J	µg/m^3	GP10-09 (8/21/2018)	1/2	3.3	1.5	--		N	NTX
591-78-6	2-Hexanone	1.7 J	1.7 J	µg/m^3	GP10-09 (8/21/2018)	1/2	2.4	1.7	104	N	N	BSV
135-98-8	2-Phenylbutane (sec-Butylbenzene)	ND	ND	µg/m^3	--	0/2	0.88 - 3.5	N/A	--		N	NTX
622-96-8	4-Ethyl toluene	2.6 J	4.0 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	4	--		N	NTX
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/m^3	--	0/2	2 - 8	N/A	10400	N	N	ND
67-64-1	Acetone	95 J	96	µg/m^3	GP10-09 (8/21/2018)	2/2	--	96	107000	N	N	BSV
107-05-1	Allyl chloride	ND	ND	µg/m^3	--	0/2	0.38 - 1.5	N/A	3	N	N	ND
71-43-2	Benzene	1.7	2.5 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	2.5	12	C	N	BSV
100-44-7	Benzyl chloride	ND	ND	µg/m^3	--	0/2	1 - 4	N/A	2	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/m^3	--	0/2	0.74 - 2.9	N/A	3	C	N	ND
75-25-2	Bromoform	ND	ND	µg/m^3	--	0/2	1.2 - 5	N/A	85	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/m^3	--	0/2	0.31 - 1.2	N/A	17	N	N	ND
106-97-8	Butane	1.8 J	3.1	µg/m^3	GP10-09 (8/21/2018)	2/2	--	3.1	--		N	NTX
75-15-0	Carbon disulfide	4.7	34	µg/m^3	GP09-09 (8/21/2018)	2/2	--	34	2430	N	N	BSV

Table 2.30

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU5-EU8 Soil Vapor (Barnett)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU5-EU8 Soil Vapor (Barnett)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
56-23-5	Carbon tetrachloride	ND	ND	µg/m^3	--	0/2	0.6 - 2.4	N/A	16	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/m^3	--	0/2	0.56 - 2.3	N/A	174	N	N	ND
75-45-6	Chlorodifluoromethane	4.1 J	5.3	µg/m^3	GP10-09 (8/21/2018)	2/2	--	5.3	174000	N	N	BSV
75-00-3	Chloroethane	ND	ND	µg/m^3	--	0/2	0.23 - 0.92	N/A	34800	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/m^3	--	0/2	0.46 - 1.9	N/A	4	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/m^3	--	0/2	0.83 - 3.3	N/A	313	N	N	ND
156-59-2	cis-1,2-Dichloroethene	3.2	3.2	µg/m^3	GP10-09 (8/21/2018)	1/2	2.4	3.2	--		N	NTX
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/2	0.84 - 3.4	N/A	23	C	N	ND
110-82-7	Cyclohexane	1.1 J	2.5 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	2.5	20900	N	N	BSV
99-87-6	Cymene (p-Isopropyltoluene)	ND	ND	µg/m^3	--	0/2	0.78 - 3.1	N/A	--		N	NTX
124-48-1	Dibromochloromethane	ND	ND	µg/m^3	--	0/2	0.89 - 3.6	N/A	--		N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	3.6 J	9	µg/m^3	GP10-09 (8/21/2018)	2/2	--	9	348	N	N	BSV
100-41-4	Ethylbenzene	3.4	11	µg/m^3	GP09-09 (8/21/2018)	2/2	--	11	37	C	N	BSV
87-68-3	Hexachlorobutadiene	ND	ND	µg/m^3	--	0/2	2.1 - 8.3	N/A	4	C	N	ND
110-54-3	Hexane	1.7 J	3.5 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	3.5	2430	N	N	BSV
67-63-0	Isopropyl alcohol	140	160	µg/m^3	GP10-09 (8/21/2018)	2/2	--	160	695	N	N	BSV
98-82-8	Isopropyl benzene (Cumene)	2.6 J	4.4 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	4.4	1390	N	N	BSV
80-62-6	Methyl methacrylate	ND	ND	µg/m^3	--	0/2	0.81 - 3.2	N/A	2430	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/m^3	--	0/2	1.5 - 6.1	N/A	360	C	N	ND
75-09-2	Methylene chloride	3.6 J	14 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	14	2090	N	N	BSV
91-20-3	Naphthalene	1.5 J	1.5 J	µg/m^3	GP10-09 (8/21/2018)	1/2	4.7	1.5	3	C	N	BSV
104-51-8	N-Butylbenzene	2.4 J	2.4 J	µg/m^3	GP10-09 (8/21/2018)	1/2	2.5	2.4	--		N	NTX
142-82-5	N-Heptane	3.4 J	14 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	14	1390	N	N	BSV
103-65-1	N-Propylbenzene	1.5 J	1.5 J	µg/m^3	GP10-09 (8/21/2018)	1/2	2.8	1.5	3480	N	N	BSV
100-42-5	Styrene	1.7 J	1.7 J	µg/m^3	GP10-09 (8/21/2018)	1/2	2.5	1.7	3480	N	N	BSV
75-65-0	tert-Butyl alcohol	5.1 J	8.5 J	µg/m^3	GP10-09 (8/21/2018)	2/2	--	8.5	104000 (5)	N	N	BSV
98-06-6	tert-Butylbenzene	ND	ND	µg/m^3	--	0/2	0.91 - 3.6	N/A	--		N	NTX
127-18-4	Tetrachloroethene	13	26	µg/m^3	GP09-09 (8/21/2018)	2/2	--	26	139	N	N	BSV
109-99-9	Tetrahydrofuran	3.7 J	4.7 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	4.7	6950	N	N	BSV
108-88-3	Toluene	13	38	µg/m^3	GP09-09 (8/21/2018)	2/2	--	38	17400	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	1.4 J	2.2 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	2.2	--		N	NTX
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/2	0.54 - 2.2	N/A	23	C	N	ND
79-01-6	**Trichloroethene**	**34**	**690**	**µg/m^3**	**GP09-09 (8/21/2018)**	**2/2**	**--**	**690**	**7**	**N**	**Y**	**ASV**

Table 2.30

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU5-EU8 Soil Vapor (Barnett)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU5-EU8 Soil Vapor (Barnett)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
75-69-4	Trichlorofluoromethane (CFC-11)	0.76 J	2.9 J	µg/m^3	GP09-09 (8/21/2018)	2/2	--	2.9	17400 (5)	N	N	BSV
76-13-1	Trifluorotrichloroethane (CFC-113)	1.5 J	1.5 J	µg/m^3	GP10-09 (8/21/2018)	1/2	2.4	1.5	17400	N	N	BSV
593-60-2	Vinyl bromide (Bromoethene)	ND	ND	µg/m^3	--	0/2	0.38 - 1.5	N/A	3	C	N	ND
75-01-4	Vinyl chloride	1.7	1.7	µg/m^3	GP10-09 (8/21/2018)	1/2	1.8	1.7	6	C	N	BSV
1330-20-7	Xylenes (total)	18.5	67	µg/m^3	GP09-09 (8/21/2018)	2/2	--	67	348	N	N	BSV

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: GP09-09, GP10-09.

(3) USEPA Vapor Intrusion Screening Levels (VISL), Resident, Target Sub-Slab and Near-source Soil Gas Concentration (Risk = 1E-06, HI = 0.1), November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Deletion Reason: Maximum detected below Screening Value (BSV)
Not Detected (ND)
No Toxicity Information or Appropriate Surrogate available (NTX)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,2-dichlorotetrafluoroethane (CFC 114)	-	dichlorodifluoromethane (CFC-12)
1,3-dichlorobenzene	-	1,2-dichlorobenzene
tert-butyl alcohol	-	sec-butyl alcohol
trichlorofluoromethane (CFC-11)	-	trifluorotrichloroethane (CFC-113)

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.31

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU9-EU15 Soil Vapor (Dryden Rd.)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	0.26 J	17	µg/m^3	GP3-8 (7/30/2012)	9/19	0.16 - 570	17	17400	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/m^3	--	0/19	0.42 - 720	N/A	2	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/m^3	--	0/19	0.29 - 570	N/A	1	N	N	ND
75-34-3	**1,1-Dichloroethane**	**1.5 J**	**3200**	**µg/m^3**	**GP15-09 (8/20/2018)**	**6/19**	**0.11 - 420**	**3200**	**59**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	0.32 J	6.7 J	µg/m^3	GP15-09 (8/20/2018)	3/19	0.13 - 420	6.7 J	695	N	N	BSV
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/m^3	--	0/19	0.73 - 1900	N/A	7	N	N	ND
95-63-6	1,2,4-Trimethylbenzene	1.5	11 J	µg/m^3	GP15-09 (8/20/2018)	11/17	3.1 - 83	11 J	209	N	N	BSV
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/m^3	--	0/2	2000 - 5100	N/A	0.00563	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/m^3	--	0/19	0.34 - 810	N/A	0.2	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/m^3	--	0/19	0.42 - 630	N/A	695	N	N	ND
107-06-2	1,2-Dichloroethane	0.95	1	µg/m^3	GP22-13 (8/23/2018)	1/19	0.19 - 640	1	4	C	N	BSV
78-87-5	1,2-Dichloropropane	ND	ND	µg/m^3	--	0/19	0.24 - 730	N/A	14	N	N	ND
76-14-2	1,2-Dichlorotetrafluoroethane (CFC 114)	8.6	11 J	µg/m^3	GP32-18 (8/24/2018)	2/17	0.22 - 60	11 J	348 (5)	N	N	BSV
108-67-8	1,3,5-Trimethylbenzene	0.37 J	2.2	µg/m^3	GP13-09 (8/20/2018)	7/17	1.3 - 86	2.2	209	N	N	BSV
106-99-0	1,3-Butadiene	ND	ND	µg/m^3	--	0/17	0.14 - 38	N/A	3	C	N	ND
541-73-1	1,3-Dichlorobenzene	0.58 J	6.9	µg/m^3	GP30-18 (8/22/2018)	4/19	0.39 - 1300	6.9	695 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/m^3	--	0/19	0.38 - 1300	N/A	9	C	N	ND
123-91-1	1,4-Dioxane	0.43 J	0.43 J	µg/m^3	GP30-18 (8/22/2018)	1/17	0.29 - 77	0.43 J	19	C	N	BSV
540-84-1	2,2,4-Trimethylpentane	0.41 J	3600	µg/m^3	GP16-09 (8/23/2018)	7/17	0.18 - 49	3600	--		N	NTX
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	2.6 J	18	µg/m^3	GP24A-13 (8/22/2018)	10/19	5.9 - 1500	18	17400	N	N	BSV
95-49-8	2-Chlorotoluene	ND	ND	µg/m^3	--	0/14	0.33 - 87	N/A	--		N	NTX
591-78-6	2-Hexanone	0.90 J	4.1 J	µg/m^3	GP12-09 (8/20/2018)	8/19	0.95 - 2100	4.1 J	104	N	N	BSV
135-98-8	2-Phenylbutane (sec-Butylbenzene)	ND	ND	µg/m^3	--	0/14	0.35 - 94	N/A	--		N	NTX
622-96-8	4-Ethyl toluene	0.39 J	1.9 J	µg/m^3	GP13-09 (8/20/2018)	5/17	0.32 - 87	1.9 J	--		N	NTX
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	1.0 J	3.9	µg/m^3	GP24A-13 (8/22/2018)	6/19	0.8 - 2100	3.9	10400	N	N	BSV
67-64-1	Acetone	21	130	µg/m^3	GP12-09 (8/20/2018)	11/19	18 - 1200	130	107000	N	N	BSV
107-05-1	Allyl chloride	ND	ND	µg/m^3	--	0/17	0.15 - 40	N/A	3	N	N	ND
71-43-2	Benzene	0.32 J	5.5	µg/m^3	GP4-16 (7/30/2012)	9/19	0.72 - 500	5.5	12	C	N	BSV
100-44-7	Benzyl chloride	ND	ND	µg/m^3	--	0/17	0.4 - 110	N/A	2	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/m^3	--	0/19	0.29 - 700	N/A	3	C	N	ND
75-25-2	Bromoform	ND	ND	µg/m^3	--	0/19	0.5 - 1100	N/A	85	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	0.18 J	0.98 J	µg/m^3	GP23-13 (8/22/2018)	3/19	0.12 - 810	0.98 J	17	N	N	BSV
106-97-8	Butane	0.96	6800	µg/m^3	GP16-09 (8/23/2018)	10/14	0.69 - 46	6800	--		N	NTX
75-15-0	Carbon disulfide	1.6	270 J	µg/m^3	GP31-18 (8/22/2018)	13/19	9.3 - 1600	270 J	2430	N	N	BSV

Table 2.31

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU9-EU15 Soil Vapor (Dryden Rd.)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
56-23-5	**Carbon tetrachloride**	**0.27 J**	**36**	**µg/m^3**	**GP24A-13 (8/22/2018)**	**5/19**	**0.24 - 660**	**36**	**16**	**C**	**Y**	**ASV**
108-90-7	Chlorobenzene	0.23 J	0.38 J	µg/m^3	GP22-13 (8/23/2018)	2/19	0.23 - 480	0.38 J	174	N	N	BSV
75-45-6	Chlorodifluoromethane	0.94	110	µg/m^3	GP16-09 (8/23/2018)	12/14	18 - 35	110	174000	N	N	BSV
75-00-3	Chloroethane	0.14 J	12 J	µg/m^3	GP15-09 (8/20/2018)	6/19	0.092 - 550	12 J	34800	N	N	BSV
67-66-3	**Chloroform (Trichloromethane)**	**0.29 J**	**110 J**	**µg/m^3**	**GP31-18 (8/22/2018)**	**10/19**	**0.19 - 510**	**110 J**	**4**	**C**	**Y**	**ASV**
74-87-3	Chloromethane (Methyl chloride)	0.46 J	3.5	µg/m^3	GP30-18 (8/22/2018)	7/19	0.33 - 430	3.5	313	N	N	BSV
156-59-2	cis-1,2-Dichloroethene	3.1 J	16000	µg/m^3	GP20-09 (9/14/2009)	9/19	0.24 - 24	16000	--		N	NTX
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/19	0.34 - 480	N/A	23	C	N	ND
110-82-7	Cyclohexane	0.53 J	49 J	µg/m^3	GP16-09 (8/23/2018)	5/19	0.14 - 360	49 J	20900	N	N	BSV
99-87-6	Cymene (p-Isopropyltoluene)	ND	ND	µg/m^3	--	0/14	0.31 - 84	N/A	--		N	NTX
124-48-1	Dibromochloromethane	ND	ND	µg/m^3	--	0/19	0.36 - 890	N/A	--		N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	0.46 J	29	µg/m^3	GP32-18 (8/24/2018)	12/19	3.8 - 780	29	348	N	N	BSV
100-41-4	Ethylbenzene	1	4.2	µg/m^3	GP4-16 (7/30/2012)	8/19	1.2 - 460	4.2	37	C	N	BSV
87-68-3	Hexachlorobutadiene	ND	ND	µg/m^3	--	0/17	0.83 - 220	N/A	4	C	N	ND
110-54-3	Hexane	0.73 J	210	µg/m^3	GP16-09 (8/23/2018)	11/17	0.45 - 30	210	2430	N	N	BSV
67-63-0	Isopropyl alcohol	1.6 J	120 J	µg/m^3	GP31-18 (8/22/2018)	12/17	6.8 - 24	120 J	695	N	N	BSV
98-82-8	Isopropyl benzene (Cumene)	0.81 J	2.3	µg/m^3	GP30-18 (8/22/2018)	3/19	0.29 - 520	2.3	1390	N	N	BSV
80-62-6	Methyl methacrylate	ND	ND	µg/m^3	--	0/14	0.32 - 87	N/A	2430	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/m^3	--	0/19	0.61 - 380	N/A	360	C	N	ND
75-09-2	Methylene chloride	1.2 J	21	µg/m^3	GP24B-13 (8/22/2018)	6/19	1.1 - 360	21	2090	N	N	BSV
91-20-3	Naphthalene	0.79 J	1.0 J	µg/m^3	GP13-09 (8/20/2018)	2/16	0.47 - 1600	1.0 J	3	C	N	BSV
104-51-8	N-Butylbenzene	0.31 J	2.0 J	µg/m^3	GP13-09 (8/20/2018)	5/14	0.25 - 68	2.0 J	--		N	NTX
142-82-5	N-Heptane	0.44 J	2.3	µg/m^3	GP22-13 (8/23/2018)	7/17	0.77 - 52	2.3	1390	N	N	BSV
103-65-1	N-Propylbenzene	0.29 J	1.1 J	µg/m^3	GP13-09 (8/20/2018)	4/17	0.28 - 74	1.1 J	3480	N	N	BSV
100-42-5	Styrene	0.25 J	0.94	µg/m^3	GP30-18 (8/22/2018)	5/19	0.25 - 450	0.94	3480	N	N	BSV
75-65-0	tert-Butyl alcohol	0.64 J	11 J	µg/m^3	GP12-09 (8/20/2018)	11/14	12 - 31	11 J	104000 (5)	N	N	BSV
98-06-6	tert-Butylbenzene	1.7 J	1.8 J	µg/m^3	GP22-13 (8/23/2018)	1/14	0.36 - 97	1.8 J	--		N	NTX
127-18-4	**Tetrachloroethene**	**1.3 J**	**370**	**µg/m^3**	**GP14-09 (8/20/2018)**	**10/19**	**0.27 - 710**	**370**	**139**	**N**	**Y**	**ASV**
109-99-9	Tetrahydrofuran	0.57 J	3.0 J	µg/m^3	GP32-18 (8/24/2018)	6/17	0.19 - 50	3.0 J	6950	N	N	BSV
108-88-3	Toluene	1.3	10	µg/m^3	GP4-16 (7/30/2012)	9/19	2.8 - 400	10	17400	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	1.0 J	330	µg/m^3	GP31-18 (8/22/2018)	12/19	0.2 - 160	330	--		N	NTX
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/19	0.22 - 480	N/A	23	C	N	ND
79-01-6	**Trichloroethene**	**0.75 J**	**56000**	**µg/m^3**	**GP20-09 (9/14/2009)**	**17/19**	**0.19 - 20**	**56000**	**7**	**N**	**Y**	**ASV**

Table 2.31

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU9-EU15 Soil Vapor (Dryden Rd.)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
75-69-4	Trichlorofluoromethane (CFC-11)	0.36 J	7.3	µg/m^3	GP23-13 (8/22/2018)	10/19	0.13 - 590	7.3	17400 (5)	N	N	BSV
76-13-1	Trifluorotrichloroethane (CFC-113)	0.45 J	6.6	µg/m^3	GP13-09 (8/20/2018)	4/19	0.24 - 800	6.6	17400	N	N	BSV
593-60-2	Vinyl bromide (Bromoethene)	ND	ND	µg/m^3	--	0/14	0.15 - 41	N/A	3	C	N	ND
75-01-4	**Vinyl chloride**	**0.30 J**	**370**	**µg/m^3**	**GP16-09 (8/23/2018)**	**5/19**	**0.18 - 540**	**370**	**6**	**C**	**Y**	**ASV**
1330-20-7	Xylenes (total)	4.4	19.1	µg/m^3	GP23-13 (8/22/2018)	10/19	3.2 - 460	19.1	348	N	N	BSV

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: GP12-09, GP13-09, GP14-09, GP15-09, GP16-09, GP20-09, GP20-18, GP22-13, GP23-13, GP24B-13, GP30-18, GP31-18, GP32-18, GP33-18, GP3-8, GP4-16, GP6-12.

(3) USEPA Vapor Intrusion Screening Levels (VISL), Resident, Target Sub-Slab and Near-source Soil Gas Concentration (Risk = 1E-06, HI = 0.1), November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Deletion Reason: Maximum detected below Screening Value (BSV)
Not Detected (ND)
No Toxicity Information or Appropriate Surrogate available (NTX)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,2-dichlorotetrafluoroethane (CFC 114)	-	dichlorodifluoromethane (CFC-12)
1,3-dichlorobenzene	-	1,2-dichlorobenzene
tert-butyl alcohol	-	sec-butyl alcohol
trichlorofluoromethane (CFC-11)	-	trifluorotrichloroethane (CFC-113)

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.32

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Soil Vapor (Valley Asphalt)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Soil Vapor (Valley Asphalt)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	22	22	µg/m^3	GP17-09 (9/11/2009)	1/6	4.8 - 550	22	17400	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/m^3	--	0/6	6.2 - 700	N/A	2	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/m^3	--	0/6	4.9 - 550	N/A	1	N	N	ND
75-34-3	**1,1-Dichloroethane**	**340**	**400 J**	**µg/m^3**	**GP18-09 (9/11/2009)**	**2/6**	**3.1 - 80**	**400**	**59**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	11 J	39	µg/m^3	GP19-09 (9/14/2009)	3/6	27 - 400	39	695	N	N	BSV
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/m^3	--	0/6	18 - 1900	N/A	7	N	N	ND
95-63-6	1,2,4-Trimethylbenzene	ND	ND	µg/m^3	--	0/2	9.2 - 64	N/A	209	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/m^3	--	0/4	29 - 4900	N/A	0.00563	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/m^3	--	0/6	9.2 - 780	N/A	0.2	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/m^3	--	0/6	7.2 - 610	N/A	695	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/m^3	--	0/6	2.4 - 610	N/A	4	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/m^3	--	0/6	2.8 - 700	N/A	14	N	N	ND
76-14-2	1,2-Dichlorotetrafluoroethane (CFC 114)	110 J	120 J	µg/m^3	GP01-18 (8/24/2018)	1/2	6.6	120	348 (5)	N	N	BSV
108-67-8	1,3,5-Trimethylbenzene	ND	ND	µg/m^3	--	0/2	9.5 - 66	N/A	209	N	N	ND
106-99-0	1,3-Butadiene	ND	ND	µg/m^3	--	0/2	4.2 - 29	N/A	3	C	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/m^3	--	0/6	7.2 - 1200	N/A	695 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/m^3	--	0/6	7.2 - 1200	N/A	9	C	N	ND
123-91-1	1,4-Dioxane	ND	ND	µg/m^3	--	0/2	8.5 - 60	N/A	19	C	N	ND
540-84-1	2,2,4-Trimethylpentane	190	3600	µg/m^3	GP01-18 (8/24/2018)	2/2	--	3600	--		N	NTX
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	5.9 J	35 J	µg/m^3	GP19-18 (8/23/2018)	2/6	27 - 1500	35	17400	N	N	BSV
95-49-8	2-Chlorotoluene	ND	ND	µg/m^3	--	0/2	9.7 - 67	N/A	--		N	NTX
591-78-6	2-Hexanone	ND	ND	µg/m^3	--	0/6	6.1 - 2100	N/A	104	N	N	ND
135-98-8	2-Phenylbutane (sec-Butylbenzene)	ND	ND	µg/m^3	--	0/2	10 - 73	N/A	--		N	NTX
622-96-8	4-Ethyl toluene	ND	ND	µg/m^3	--	0/2	9.6 - 67	N/A	--		N	NTX
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/m^3	--	0/6	4.9 - 2100	N/A	10400	N	N	ND
67-64-1	Acetone	340 J	340 J	µg/m^3	GP19-18 (8/23/2018)	1/6	22 - 1200	340	107000	N	N	BSV
107-05-1	Allyl chloride	ND	ND	µg/m^3	--	0/2	4.4 - 31	N/A	3	N	N	ND
71-43-2	**Benzene**	**16**	**14000**	**µg/m^3**	**GP18-09 (9/11/2009)**	**6/6**	**--**	**14000**	**12**	**C**	**Y**	**ASV**
100-44-7	Benzyl chloride	ND	ND	µg/m^3	--	0/2	12 - 84	N/A	2	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/m^3	--	0/6	6 - 680	N/A	3	C	N	ND
75-25-2	Bromoform	ND	ND	µg/m^3	--	0/6	12 - 1000	N/A	85	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	8.2 J	8.2 J	µg/m^3	GP19-09 (9/14/2009)	1/6	3.7 - 790	8.2	17	N	N	BSV
106-97-8	Butane	940	4000	µg/m^3	GP01-18 (8/24/2018)	2/2	--	4000	--		N	NTX
75-15-0	Carbon disulfide	10 J	58 J	µg/m^3	GP01-18 (8/24/2018)	4/6	310 - 1600	58	2430	N	N	BSV

Table 2.32

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Soil Vapor (Valley Asphalt)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Soil Vapor (Valley Asphalt)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
56-23-5	Carbon tetrachloride	ND	ND	µg/m^3	--	0/6	5.6 - 640	N/A	16	C	N	ND
108-90-7	**Chlorobenzene**	**2.4 J**	**110000**	**µg/m^3**	**GP01-18 (8/24/2018)**	**3/6**	**6.7 - 470**	**110000**	**174**	**N**	**Y**	**ASV**
75-45-6	Chlorodifluoromethane	540	580	µg/m^3	GP01-18 (8/24/2018)	1/2	3.9	580	174000	N	N	BSV
75-00-3	Chloroethane	8.1 J	1400	µg/m^3	GP18-09 (9/11/2009)	4/6	3.2 - 100	1400	34800	N	N	BSV
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/m^3	--	0/6	4.4 - 490	N/A	4	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/m^3	--	0/6	4.9 - 420	N/A	313	N	N	ND
156-59-2	cis-1,2-Dichloroethene	20	1700	µg/m^3	GP19-18 (8/23/2018)	6/6	--	1700	--		N	NTX
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/6	5.4 - 460	N/A	23	C	N	ND
110-82-7	**Cyclohexane**	**42**	**50000**	**µg/m^3**	**GP18-09 (9/11/2009)**	**6/6**	**--**	**50000**	**20900**	**N**	**Y**	**ASV**
99-87-6	Cymene (p-Isopropyltoluene)	ND	ND	µg/m^3	--	0/2	9.3 - 65	N/A	--		N	NTX
124-48-1	Dibromochloromethane	ND	ND	µg/m^3	--	0/6	10 - 860	N/A	--		N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/m^3	--	0/6	5.9 - 750	N/A	348	N	N	ND
100-41-4	**Ethylbenzene**	**7**	**48000**	**µg/m^3**	**GP18-09 (9/11/2009)**	**6/6**	**--**	**48000**	**37**	**C**	**Y**	**ASV**
87-68-3	Hexachlorobutadiene	ND	ND	µg/m^3	--	0/2	25 - 170	N/A	4	C	N	ND
110-54-3	Hexane	340	1300	µg/m^3	GP01-18 (8/24/2018)	2/2	--	1300	2430	N	N	BSV
67-63-0	Isopropyl alcohol	76 J	76 J	µg/m^3	GP19-18 (8/23/2018)	1/2	46 - 48	76	695	N	N	BSV
98-82-8	**Isopropyl benzene (Cumene)**	**260**	**4100**	**µg/m^3**	**GP18-09 (9/11/2009)**	**2/6**	**7.4 - 61**	**4100**	**1390**	**N**	**Y**	**ASV**
80-62-6	Methyl methacrylate	ND	ND	µg/m^3	--	0/2	9.6 - 67	N/A	2430	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/m^3	--	0/6	6.6 - 370	N/A	360	C	N	ND
75-09-2	Methylene chloride	59 J	59 J	µg/m^3	GP01-09 (9/29/2009)	1/6	3.1 - 350	59	2090	N	N	BSV
91-20-3	**Naphthalene**	**5.6 J**	**980 J**	**µg/m^3**	**GP18-09 (9/11/2009)**	**2/6**	**14 - 310**	**980**	**3**	**C**	**Y**	**ASV**
104-51-8	N-Butylbenzene	ND	ND	µg/m^3	--	0/2	7.5 - 52	N/A	--		N	NTX
142-82-5	**N-Heptane**	**330**	**1600**	**µg/m^3**	**GP01-18 (8/24/2018)**	**2/2**	**--**	**1600**	**1390**	**N**	**Y**	**ASV**
103-65-1	N-Propylbenzene	ND	ND	µg/m^3	--	0/2	8.1 - 57	N/A	3480	N	N	ND
100-42-5	Styrene	ND	ND	µg/m^3	--	0/6	5.1 - 430	N/A	3480	N	N	ND
75-65-0	tert-Butyl alcohol	8.3 J	8.3 J	µg/m^3	GP19-18 (8/23/2018)	1/2	23 - 24	8.3	104000 (5)	N	N	BSV
98-06-6	tert-Butylbenzene	ND	ND	µg/m^3	--	0/2	11 - 75	N/A	--		N	NTX
127-18-4	Tetrachloroethene	48	48	µg/m^3	GP17-09 (9/11/2009)	1/6	8 - 690	48	139	N	N	BSV
109-99-9	Tetrahydrofuran	ND	ND	µg/m^3	--	0/2	5.5 - 38	N/A	6950	N	N	ND
108-88-3	Toluene	13	2800	µg/m^3	GP18-09 (9/11/2009)	6/6	--	2800	17400	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	1.3 J	30	µg/m^3	GP19-18 (8/23/2018)	2/6	7.2 - 400	30	--		N	NTX
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/6	5.4 - 460	N/A	23	C	N	ND
79-01-6	**Trichloroethene**	**13 J**	**360**	**µg/m^3**	**GP19-09 (9/14/2009)**	**3/6**	**38 - 540**	**360**	**7**	**N**	**Y**	**ASV**

Table 2.32

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU16 Soil Vapor (Valley Asphalt)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Soil Vapor (Valley Asphalt)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/m^3	--	0/6	4 - 570	N/A	17400 (5)	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/m^3	--	0/6	7 - 780	N/A	17400	N	N	ND
593-60-2	Vinyl bromide (Bromoethene)	ND	ND	µg/m^3	--	0/2	4.5 - 32	N/A	3	C	N	ND
75-01-4	**Vinyl chloride**	**370**	**4800**	**µg/m^3**	**GP18-09 (9/11/2009)**	**6/6**	**--**	**4800**	**6**	**C**	**Y**	**ASV**
1330-20-7	**Xylenes (total)**	**29**	**47000**	**µg/m^3**	**GP18-09 (9/11/2009)**	**6/6**	**--**	**47000**	**348**	**N**	**Y**	**ASV**

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: GP01-18, GP19-18, GP01-09, GP17-09, GP18-09, GP19-09.

(3) USEPA Vapor Intrusion Screening Levels (VISL), Resident, Target Sub-Slab and Near-source Soil Gas Concentration (Risk = 1E-06, HI = 0.1), November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Deletion Reason: Maximum detected below Screening Value (BSV)
Not Detected (ND)
No Toxicity Information or Appropriate Surrogate available (NTX)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,2-dichlorotetrafluoroethane (CFC 114)	-	dichlorodifluoromethane (CFC-12)
1,3-dichlorobenzene	-	1,2-dichlorobenzene
tert-butyl alcohol	-	sec-butyl alcohol
trichlorofluoromethane (CFC-11)	-	trifluorotrichloroethane (CFC-113)

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.33

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU18-EU19 Soil Vapor (Central)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Soil Vapor (Central)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	2.1 J	33	µg/m^3	GP03-09 (8/14/2018)	7/11	2.2 - 19	33	17400	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/m^3	--	0/11	0.42 - 48	N/A	2	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/m^3	--	0/11	0.29 - 34	N/A	1	N	N	ND
75-34-3	1,1-Dichloroethane	1.5 J	41 J	µg/m^3	GP27-18 (8/15/2018)	10/11	0.11	41	59	C	N	BSV
75-35-4	1,1-Dichloroethene	24	24	µg/m^3	GP25-18 (8/14/2018)	1/11	0.13 - 15	24	695	N	N	BSV
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/m^3	--	0/11	0.73 - 83	N/A	7	N	N	ND
95-63-6	1,2,4-Trimethylbenzene	12 J	120	µg/m^3	GP27-18 (8/15/2018)	8/11	3.1 - 14	120	209	N	N	BSV
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/m^3	--	0/11	0.34 - 38	N/A	0.2	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/m^3	--	0/11	0.42 - 48	N/A	695	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/m^3	--	0/11	0.19 - 22	N/A	4	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/m^3	--	0/11	0.24 - 27	N/A	14	N	N	ND
76-14-2	1,2-Dichlorotetrafluoroethane (CFC 114)	0.22 J	310	µg/m^3	GP02-09 (8/15/2018)	6/11	0.22 - 25	310	348 (5)	N	N	BSV
108-67-8	1,3,5-Trimethylbenzene	4.4	52 J	µg/m^3	GP27-18 (8/15/2018)	5/11	3.2 - 15	52	209	N	N	BSV
106-99-0	1,3-Butadiene	ND	ND	µg/m^3	--	0/11	0.14 - 16	N/A	3	C	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/m^3	--	0/11	0.39 - 44	N/A	695 (5)	N	N	ND
106-46-7	**1,4-Dichlorobenzene**	**74 J**	**74 J**	**µg/m^3**	**GP27-18 (8/15/2018)**	**1/11**	**0.38 - 18**	**74**	**9**	**C**	**Y**	**ASV**
123-91-1	1,4-Dioxane	ND	ND	µg/m^3	--	0/11	0.29 - 33	N/A	19	C	N	ND
540-84-1	2,2,4-Trimethylpentane	10 J	33 J	µg/m^3	GP21-09 (8/14/2018)	4/11	0.18 - 21	33	--		N	NTX
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	9.8	24 J	µg/m^3	GP04-09 (8/14/2018)	3/11	5.9 - 67	24	17400	N	N	BSV
95-49-8	2-Chlorotoluene	ND	ND	µg/m^3	--	0/11	0.33 - 37	N/A	--		N	NTX
591-78-6	2-Hexanone	1.5 J	8.9 J	µg/m^3	GP02-09 (8/15/2018)	3/11	2.4 - 27	8.9	104	N	N	BSV
135-98-8	2-Phenylbutane (sec-Butylbenzene)	30 J	47 J	µg/m^3	GP28-18 (8/15/2018)	2/11	0.35 - 40	47	--		N	NTX
622-96-8	4-Ethyl toluene	4.5 J	72 J	µg/m^3	GP27-18 (8/15/2018)	6/11	3.2 - 15	72	--		N	NTX
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.86 J	1.4 J	µg/m^3	GP05-09 (8/14/2018)	2/11	8 - 91	1.4	10400	N	N	BSV
67-64-1	Acetone	37 J	460	µg/m^3	GP04-09 (8/14/2018)	5/11	67 - 380	460	107000	N	N	BSV
107-05-1	Allyl chloride	ND	ND	µg/m^3	--	0/11	0.15 - 17	N/A	3	N	N	ND
71-43-2	**Benzene**	**0.41 J**	**410**	**µg/m^3**	**GP27-18 (8/15/2018)**	**10/11**	**3.6**	**410**	**12**	**C**	**Y**	**ASV**
100-44-7	Benzyl chloride	ND	ND	µg/m^3	--	0/11	0.4 - 46	N/A	2	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/m^3	--	0/11	0.29 - 34	N/A	3	C	N	ND
75-25-2	Bromoform	ND	ND	µg/m^3	--	0/11	0.5 - 56	N/A	85	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	0.19 J	0.35 J	µg/m^3	GP03-09 (8/14/2018)	2/11	1.2 - 14	0.35	17	N	N	BSV
106-97-8	Butane	0.74 J	8100	µg/m^3	GP27-18 (8/15/2018)	11/11	--	8100	--		N	NTX
75-15-0	Carbon disulfide	13 J	240	µg/m^3	GP26-18 (8/14/2018)	11/11	--	240	2430	N	N	BSV

Table 2.33

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU18-EU19 Soil Vapor (Central)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Soil Vapor (Central)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
56-23-5	Carbon tetrachloride	ND	ND	µg/m^3	--	0/11	0.24 - 27	N/A	16	C	N	ND
108-90-7	**Chlorobenzene**	**4.7 J**	**9200**	**µg/m^3**	**GP27-18 (8/15/2018)**	**4/11**	**0.23 - 4.5**	**9200**	**174**	**N**	**Y**	**ASV**
75-45-6	Chlorodifluoromethane	0.52 J	470	µg/m^3	GP02-09 (8/15/2018)	10/11	15	470	174000	N	N	BSV
75-00-3	Chloroethane	0.27 J	550	µg/m^3	GP26-18 (8/14/2018)	8/11	0.92 - 1.8	550	34800	N	N	BSV
67-66-3	**Chloroform (Trichloromethane)**	**8.0 J**	**18**	**µg/m^3**	**GP03-09 (8/14/2018)**	**2/11**	**0.19 - 21**	**18**	**4**	**C**	**Y**	**ASV**
74-87-3	Chloromethane (Methyl chloride)	0.45 J	1.2	µg/m^3	GP03-09 (8/14/2018)	2/11	3.3 - 38	1.2	313	N	N	BSV
156-59-2	cis-1,2-Dichloroethene	0.93	95	µg/m^3	GP29-18 (8/15/2018)	7/11	0.24 - 27	95	--		N	NTX
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/11	0.34 - 38	N/A	23	C	N	ND
110-82-7	Cyclohexane	0.41 J	350 J	µg/m^3	GP27-18 (8/15/2018)	10/11	1.4	350	20900	N	N	BSV
99-87-6	Cymene (p-Isopropyltoluene)	0.44 J	0.46 J	µg/m^3	GP03-09 (8/14/2018)	2/11	3.1 - 36	0.46	--		N	NTX
124-48-1	Dibromochloromethane	ND	ND	µg/m^3	--	0/11	0.36 - 41	N/A	--		N	ND
75-71-8	**Dichlorodifluoromethane (CFC-12)**	**1.1**	**570**	**µg/m^3**	**GP05-09 (8/14/2018)**	**7/11**	**6.7 - 38**	**570**	**348**	**N**	**Y**	**ASV**
100-41-4	**Ethylbenzene**	**2.9**	**150**	**µg/m^3**	**GP27-18 (8/15/2018)**	**7/11**	**3 - 13**	**150**	**37**	**C**	**Y**	**ASV**
87-68-3	Hexachlorobutadiene	ND	ND	µg/m^3	--	0/11	0.83 - 95	N/A	4	C	N	ND
110-54-3	**Hexane**	**0.92 J**	**3100**	**µg/m^3**	**GP27-18 (8/15/2018)**	**11/11**	**--**	**3100**	**2430**	**N**	**Y**	**ASV**
67-63-0	Isopropyl alcohol	2.3 J	46 J	µg/m^3	GP32-18 (8/24/2018)	8/11	9 - 26	46	695	N	N	BSV
98-82-8	Isopropyl benzene (Cumene)	71 J	92	µg/m^3	GP28-18 (8/15/2018)	2/11	0.29 - 34	92	1390	N	N	BSV
80-62-6	Methyl methacrylate	ND	ND	µg/m^3	--	0/11	0.32 - 37	N/A	2430	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/m^3	--	0/11	0.61 - 70	N/A	360	C	N	ND
75-09-2	Methylene chloride	1.1 J	40	µg/m^3	GP25-18 (8/14/2018)	3/11	11 - 130	40	2090	N	N	BSV
91-20-3	Naphthalene	1.1 J	1.1 J	µg/m^3	GP03-09 (8/14/2018)	2/11	4.7 - 54	1.1	3	C	N	BSV
104-51-8	N-Butylbenzene	2.8 J	16 J	µg/m^3	GP28-18 (8/15/2018)	6/11	2.5 - 29	16	--		N	NTX
142-82-5	**N-Heptane**	**0.54 J**	**1800**	**µg/m^3**	**GP27-18 (8/15/2018)**	**10/11**	**1.9**	**1800**	**1390**	**N**	**Y**	**ASV**
103-65-1	N-Propylbenzene	2.7	95 J	µg/m^3	GP27-18 (8/15/2018)	5/11	2.8 - 13	95	3480	N	N	BSV
100-42-5	Styrene	3.2	3.5	µg/m^3	GP03-09 (8/14/2018)	2/11	2.5 - 28	3.5	3480	N	N	BSV
75-65-0	tert-Butyl alcohol	2.3 J	8.0 J	µg/m^3	GP04-09 (8/14/2018)	7/11	2.3 - 13	8	104000 (5)	N	N	BSV
98-06-6	tert-Butylbenzene	5.7 J	5.7 J	µg/m^3	GP02-09 (8/15/2018)	1/11	0.36 - 41	5.7	--		N	NTX
127-18-4	**Tetrachloroethene**	**7**	**550**	**µg/m^3**	**GP03-09 (8/14/2018)**	**3/11**	**2.7 - 31**	**550**	**139**	**N**	**Y**	**ASV**
109-99-9	Tetrahydrofuran	1.2 J	3.0 J	µg/m^3	GP32-18 (8/24/2018)	3/11	1.9 - 21	3	6950	N	N	BSV
108-88-3	Toluene	12	540	µg/m^3	GP27-18 (8/15/2018)	9/11	4.5 - 9	540	17400	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	2.9 J	28 J	µg/m^3	GP28-18 (8/15/2018)	3/11	0.2 - 23	28	--		N	NTX
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/11	0.22 - 25	N/A	23	C	N	ND
79-01-6	**Trichloroethene**	**11 J**	**590**	**µg/m^3**	**GP32-18 (8/24/2018)**	**5/11**	**0.19 - 22**	**590**	**7**	**N**	**Y**	**ASV**

Table 2.33

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU18-EU19 Soil Vapor (Central)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Soil Vapor (Central)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
75-69-4	Trichlorofluoromethane (CFC-11)	2.6	5.0 J	µg/m^3	GP25-18 (8/14/2018)	4/11	1.3 - 15	5	17400 (5)	N	N	BSV
76-13-1	Trifluorotrichloroethane (CFC-113)	0.60 J	0.72 J	µg/m^3	GP03-09 (8/14/2018)	2/11	2.4 - 27	0.72	17400	N	N	BSV
593-60-2	Vinyl bromide (Bromoethene)	ND	ND	µg/m^3	--	0/11	0.15 - 17	N/A	3	C	N	ND
75-01-4	**Vinyl chloride**	**53**	**200**	**µg/m^3**	**GP28-18 (8/15/2018)**	**5/11**	**0.18 - 21**	**200**	**6**	**C**	**Y**	**ASV**
1330-20-7	**Xylenes (total)**	**18.4**	**660**	**µg/m^3**	**GP27-18 (8/15/2018)**	**9/11**	**5.2 - 10**	**660**	**348**	**N**	**Y**	**ASV**

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: GP02-09, GP03-09, GP04-09, GP05-09, GP21-09, GP25-18, GP26-18, GP27-18, GP28-18, GP29-18, GP32-18.

(3) USEPA Vapor Intrusion Screening Levels (VISL), Resident, Target Sub-Slab and Near-source Soil Gas Concentration (Risk = 1E-06, HI = 0.1), November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Deletion Reason: Maximum detected below Screening Value (BSV)
Not Detected (ND)
No Toxicity Information or Appropriate Surrogate available (NTX)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,2-dichlorotetrafluoroethane (CFC 114)	-	dichlorodifluoromethane (CFC-12)
1,3-dichlorobenzene	-	1,2-dichlorobenzene
tert-butyl alcohol	-	sec-butyl alcohol
trichlorofluoromethane (CFC-11)	-	trifluorotrichloroethane (CFC-113)

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.34

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Outside of OU1 Soil Vapor (South)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Outside of OU1 Soil Vapor (South)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	0.49 J	57	µg/m^3	GP35-19 (10/8/2019)	3/3	--	57	17400	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/m^3	--	0/3	0.42 - 5.3	N/A	2	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/m^3	--	0/3	0.28 - 4.2	N/A	1	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/m^3	--	0/3	0.11 - 3.1	N/A	59	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/m^3	--	0/3	0.13 - 3.1	N/A	695	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/m^3	--	0/3	0.73 - 23	N/A	7	N	N	ND
95-63-6	1,2,4-Trimethylbenzene	8.7	8.9	µg/m^3	GP06-09 (8/21/2018)	2/3	0.31	8.9	209	N	N	BSV
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/m^3	--	0/3	0.34 - 6	N/A	0.2	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/m^3	--	0/3	0.42 - 4.6	N/A	695	N	N	ND
107-06-2	1,2-Dichloroethane	0.89	0.89	µg/m^3	GP06-09 (8/21/2018)	1/3	0.19 - 3.1	0.89	4	C	N	BSV
78-87-5	1,2-Dichloropropane	ND	ND	µg/m^3	--	0/3	0.24 - 3.6	N/A	14	N	N	ND
76-14-2	1,2-Dichlorotetrafluoroethane (CFC 114)	ND	ND	µg/m^3	--	0/3	0.22 - 5.4	N/A	348 (5)	N	N	ND
108-67-8	1,3,5-Trimethylbenzene	2.5	2.5	µg/m^3	GP06-09 (8/21/2018)	1/3	0.32 - 3.8	2.5	209	N	N	BSV
106-99-0	1,3-Butadiene	ND	ND	µg/m^3	--	0/3	0.14 - 1.7	N/A	3	C	N	ND
541-73-1	1,3-Dichlorobenzene	0.63 J	0.63 J	µg/m^3	GP06-09 (8/21/2018)	1/3	0.39 - 4.6	0.63 J	695 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/m^3	--	0/3	0.38 - 4.6	N/A	9	C	N	ND
123-91-1	1,4-Dioxane	ND	ND	µg/m^3	--	0/3	0.29 - 11	N/A	19	C	N	ND
540-84-1	2,2,4-Trimethylpentane	17	17	µg/m^3	GP06-09 (8/21/2018)	1/3	0.18 - 3.6	17	--		N	NTX
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	2.3 J	11	µg/m^3	GP06-09 (8/21/2018)	2/3	9.1	11	17400	N	N	BSV
95-49-8	2-Chlorotoluene	ND	ND	µg/m^3	--	0/2	0.33	N/A	--		N	NTX
591-78-6	2-Hexanone	0.30 J	2.1	µg/m^3	GP06-09 (8/21/2018)	2/3	13	2.1	104	N	N	BSV
135-98-8	2-Phenylbutane (sec-Butylbenzene)	ND	ND	µg/m^3	--	0/2	0.35	N/A	--		N	NTX
622-96-8	4-Ethyl toluene	2.1	2.1	µg/m^3	GP06-09 (8/21/2018)	1/3	0.32 - 3.8	2.1	--		N	NTX
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	1.8 J	1.8 J	µg/m^3	GP06-09 (8/21/2018)	1/3	0.8 - 3.2	1.8 J	10400	N	N	BSV
67-64-1	Acetone	21	69 J	µg/m^3	GP06-09 (8/21/2018)	3/3	--	69 J	107000	N	N	BSV
107-05-1	Allyl chloride	ND	ND	µg/m^3	--	0/3	0.15 - 9.7	N/A	3	N	N	ND
71-43-2	Benzene	1.8	1.8	µg/m^3	GP06-09 (8/21/2018)	1/3	0.18 - 2.5	1.8	12	C	N	BSV
100-44-7	Benzyl chloride	ND	ND	µg/m^3	--	0/3	0.4 - 4	N/A	2	C	N	ND
75-27-4	**Bromodichloromethane**	**5.3**	**5.3**	**µg/m^3**	**GP35-19 (10/8/2019)**	**1/3**	**0.29 - 5.2**	**5.3**	**3**	**C**	**Y**	**ASV**
75-25-2	Bromoform	ND	ND	µg/m^3	--	0/3	0.5 - 8	N/A	85	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	0.14 J	0.14 J	µg/m^3	GP06-09 (8/21/2018)	1/3	0.12 - 30	0.14 J	17	N	N	BSV
106-97-8	Butane	0.72 J	0.87 J	µg/m^3	GP35-19 (10/8/2019)	2/2	--	0.87 J	--		N	NTX
75-15-0	Carbon disulfide	13	19	µg/m^3	GP35-19 (10/8/2019)	2/3	9.6	19	2430	N	N	BSV

Table 2.34

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Outside of OU1 Soil Vapor (South)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Outside of OU1 Soil Vapor (South)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
56-23-5	Carbon tetrachloride	0.58 J	0.58 J	µg/m^3	GP35-19 (10/8/2019)	1/3	0.24 - 4.9	0.58 J	16	C	N	BSV
108-90-7	Chlorobenzene	ND	ND	µg/m^3	--	0/3	0.23 - 3.6	N/A	174	N	N	ND
75-45-6	Chlorodifluoromethane	5.6	5.6	µg/m^3	GP06-09 (8/21/2018)	1/2	0.13	5.6	174000	N	N	BSV
75-00-3	Chloroethane	ND	ND	µg/m^3	--	0/3	0.092 - 8.2	N/A	34800	N	N	ND
67-66-3	**Chloroform (Trichloromethane)**	**0.38 J**	**260**	**µg/m^3**	**GP35-19 (10/8/2019)**	**2/3**	**3.8**	**260**	**4**	**C**	**Y**	**ASV**
74-87-3	Chloromethane (Methyl chloride)	0.52 J	0.55 J	µg/m^3	GP06-09 (8/21/2018)	2/3	16	0.55 J	313	N	N	BSV
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/m^3	--	0/3	0.24 - 3.1	N/A	--		N	NTX
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/3	0.34 - 3.5	N/A	23	C	N	ND
110-82-7	Cyclohexane	0.21 J	2.5	µg/m^3	GP06-09 (8/21/2018)	2/3	2.7	2.5	20900	N	N	BSV
99-87-6	Cymene (p-Isopropyltoluene)	0.40 J	0.40 J	µg/m^3	GP06-09 (8/21/2018)	1/2	0.31	0.40 J	--		N	NTX
124-48-1	Dibromochloromethane	ND	ND	µg/m^3	--	0/3	0.36 - 6.6	N/A	--		N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	1.2	1.5	µg/m^3	GP35-19 (10/8/2019)	2/3	3.8	1.5	348	N	N	BSV
100-41-4	Ethylbenzene	2.8	2.8	µg/m^3	GP06-09 (8/21/2018)	1/3	0.3 - 3.4	2.8	37	C	N	BSV
87-68-3	Hexachlorobutadiene	ND	ND	µg/m^3	--	0/3	0.83 - 33	N/A	4	C	N	ND
110-54-3	Hexane	0.28 J	15	µg/m^3	GP06-09 (8/21/2018)	2/3	2.7	15	2430	N	N	BSV
67-63-0	Isopropyl alcohol	3.6	57	µg/m^3	GP06-09 (8/21/2018)	2/3	7.6	57	695	N	N	BSV
98-82-8	Isopropyl benzene (Cumene)	1.4 J	1.4 J	µg/m^3	GP06-09 (8/21/2018)	1/3	0.29 - 3.8	1.4 J	1390	N	N	BSV
80-62-6	Methyl methacrylate	ND	ND	µg/m^3	--	0/2	0.32	N/A	2430	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/m^3	--	0/3	0.61 - 2.8	N/A	360	C	N	ND
75-09-2	Methylene chloride	7	7	µg/m^3	GP06-09 (8/21/2018)	1/3	1.8 - 27	7	2090	N	N	BSV
91-20-3	Naphthalene	0.79 J	0.79 J	µg/m^3	GP06-09 (8/21/2018)	1/2	0.47	0.79 J	3	C	N	BSV
104-51-8	N-Butylbenzene	1.8 J	1.8 J	µg/m^3	GP06-09 (8/21/2018)	1/2	0.25	1.8 J	--		N	NTX
142-82-5	N-Heptane	12	12	µg/m^3	GP06-09 (8/21/2018)	1/3	0.19 - 3.2	12	1390	N	N	BSV
103-65-1	N-Propylbenzene	1.2 J	1.2 J	µg/m^3	GP06-09 (8/21/2018)	1/3	0.28 - 3.8	1.2 J	3480	N	N	BSV
100-42-5	Styrene	1.2	1.2	µg/m^3	GP06-09 (8/21/2018)	1/3	0.25 - 3.3	1.2	3480	N	N	BSV
75-65-0	tert-Butyl alcohol	0.60 J	3.3 J	µg/m^3	GP06-09 (8/21/2018)	2/2	--	3.3 J	104000 (5)	N	N	BSV
98-06-6	tert-Butylbenzene	ND	ND	µg/m^3	--	0/2	0.36	N/A	--		N	NTX
127-18-4	Tetrachloroethene	4.3	22	µg/m^3	GP06-09 (8/21/2018)	3/3	--	22	139	N	N	BSV
109-99-9	Tetrahydrofuran	ND	ND	µg/m^3	--	0/3	0.19 - 2.3	N/A	6950	N	N	ND
108-88-3	Toluene	1.3 J	23	µg/m^3	GP06-09 (8/21/2018)	2/3	2.9	23	17400	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	0.59 J	0.59 J	µg/m^3	GP06-09 (8/21/2018)	1/3	0.2 - 3.1	0.59 J	--		N	NTX
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/3	0.22 - 3.5	N/A	23	C	N	ND
79-01-6	Trichloroethene	0.28 J	0.54 J	µg/m^3	GP35-19 (10/8/2019)	2/3	4.2	0.54 J	7	N	N	BSV

Table 2.34

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Outside of OU1 Soil Vapor (South)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Outside of OU1 Soil Vapor (South)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
75-69-4	Trichlorofluoromethane (CFC-11)	2.6	8.7	µg/m^3	GP06-09 (8/21/2018)	2/3	4.4	8.7	17400 (5)	N	N	BSV
76-13-1	Trifluorotrichloroethane (CFC-113)	0.59 J	0.60 J	µg/m^3	GP06-09 (8/21/2018)	2/3	5.9	0.60 J	17400	N	N	BSV
593-60-2	Vinyl bromide (Bromoethene)	ND	ND	µg/m^3	--	0/2	0.15	N/A	3	C	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/m^3	--	0/3	0.18 - 2	N/A	6	C	N	ND
1330-20-7	Xylenes (total)	0.78 J	16.9	µg/m^3	GP06-09 (8/21/2018)	3/3	--	16.9	348	N	N	BSV

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: GP1-8, GP06-09, GP35-19.

(3) USEPA Vapor Intrusion Screening Levels (VISL), Resident, Target Sub-Slab and Near-source Soil Gas Concentration (Risk = 1E-06, HI = 0.1), November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Deletion Reason: Maximum detected below Screening Value (BSV)
Not Detected (ND)
No Toxicity Information or Appropriate Surrogate available (NTX)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,2-dichlorotetrafluoroethane (CFC 114)	-	dichlorodifluoromethane (CFC-12)
1,3-dichlorobenzene	-	1,2-dichlorobenzene
tert-butyl alcohol	-	sec-butyl alcohol
trichlorofluoromethane (CFC-11)	-	trifluorotrichloroethane (CFC-113)

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.35

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Outside of OU1 Soil Vapor (Globe)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Outside of OU1 Soil Vapor (Globe)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	1.8	2.6	µg/m^3	GP11-09 (8/15/2018)	2/2	--	2.6	17400	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/m^3	--	0/2	0.42	N/A	2	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/m^3	--	0/2	0.29	N/A	1	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/m^3	--	0/2	0.11	N/A	59	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/m^3	--	0/2	0.13	N/A	695	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/m^3	--	0/2	0.73	N/A	7	N	N	ND
95-63-6	1,2,4-Trimethylbenzene	1.8	13	µg/m^3	GP11-09 (8/15/2018)	2/2	--	13	209	N	N	BSV
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/m^3	--	0/2	0.34	N/A	0.2	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/m^3	--	0/2	0.42	N/A	695	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/m^3	--	0/2	0.19	N/A	4	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/m^3	--	0/2	0.24	N/A	14	N	N	ND
76-14-2	1,2-Dichlorotetrafluoroethane (CFC 114)	ND	ND	µg/m^3	--	0/2	0.22	N/A	348 (5)	N	N	ND
108-67-8	1,3,5-Trimethylbenzene	0.39 J	3.7	µg/m^3	GP11-09 (8/15/2018)	2/2	--	3.7	209	N	N	BSV
106-99-0	1,3-Butadiene	ND	ND	µg/m^3	--	0/2	0.14	N/A	3	C	N	ND
541-73-1	1,3-Dichlorobenzene	2.3	2.3	µg/m^3	GP34-18 (8/22/2018)	1/2	0.39	2.3	695 (5)	N	N	BSV
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/m^3	--	0/2	0.38	N/A	9	C	N	ND
123-91-1	1,4-Dioxane	ND	ND	µg/m^3	--	0/2	0.29	N/A	19	C	N	ND
540-84-1	2,2,4-Trimethylpentane	0.88 J	0.88 J	µg/m^3	GP34-18 (8/22/2018)	1/2	0.18	0.88	--		N	NTX
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	4.7	7.8	µg/m^3	GP34-18 (8/22/2018)	2/2	--	7.8	17400	N	N	BSV
95-49-8	2-Chlorotoluene	ND	ND	µg/m^3	--	0/2	0.33	N/A	--		N	NTX
591-78-6	2-Hexanone	0.61 J	1.3 J	µg/m^3	GP34-18 (8/22/2018)	2/2	--	1.3	104	N	N	BSV
135-98-8	2-Phenylbutane (sec-Butylbenzene)	ND	ND	µg/m^3	--	0/2	0.35	N/A	--		N	NTX
622-96-8	4-Ethyl toluene	0.46 J	3.4	µg/m^3	GP11-09 (8/15/2018)	2/2	--	3.4	--		N	NTX
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.90 J	2.7	µg/m^3	GP11-09 (8/15/2018)	2/2	--	2.7	10400	N	N	BSV
67-64-1	Acetone	35	41	µg/m^3	GP11-09 (8/15/2018)	2/2	--	41	107000	N	N	BSV
107-05-1	Allyl chloride	ND	ND	µg/m^3	--	0/2	0.15	N/A	3	N	N	ND
71-43-2	Benzene	0.39 J	0.81	µg/m^3	GP34-18 (8/22/2018)	2/2	--	0.81	12	C	N	BSV
100-44-7	Benzyl chloride	ND	ND	µg/m^3	--	0/2	0.4	N/A	2	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/m^3	--	0/2	0.29	N/A	3	C	N	ND
75-25-2	Bromoform	ND	ND	µg/m^3	--	0/2	0.5	N/A	85	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	0.20 J	0.20 J	µg/m^3	GP11-09 (8/15/2018)	1/2	0.12	0.2	17	N	N	BSV
106-97-8	Butane	0.82 J	1.2	µg/m^3	GP11-09 (8/15/2018)	2/2	--	1.2	--		N	NTX
75-15-0	Carbon disulfide	21	36	µg/m^3	GP11-09 (8/15/2018)	2/2	--	36	2430	N	N	BSV

Table 2.35

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Outside of OU1 Soil Vapor (Globe)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Outside of OU1 Soil Vapor (Globe)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
56-23-5	Carbon tetrachloride	ND	ND	µg/m^3	--	0/2	0.24	N/A	16	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/m^3	--	0/2	0.23	N/A	174	N	N	ND
75-45-6	Chlorodifluoromethane	2	4.6	µg/m^3	GP34-18 (8/22/2018)	2/2	--	4.6	174000	N	N	BSV
75-00-3	Chloroethane	0.46 J	0.46 J	µg/m^3	GP11-09 (8/15/2018)	1/2	0.092	0.46	34800	N	N	BSV
67-66-3	Chloroform (Trichloromethane)	0.24 J	0.24 J	µg/m^3	GP34-18 (8/22/2018)	1/2	0.19	0.24	4	C	N	BSV
74-87-3	Chloromethane (Methyl chloride)	1.5	3.4	µg/m^3	GP11-09 (8/15/2018)	2/2	--	3.4	313	N	N	BSV
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/m^3	--	0/2	0.24	N/A	--		N	NTX
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/2	0.34	N/A	23	C	N	ND
110-82-7	Cyclohexane	0.20 J	0.67 J	µg/m^3	GP11-09 (8/15/2018)	2/2	--	0.67	20900	N	N	BSV
99-87-6	Cymene (p-Isopropyltoluene)	0.39 J	0.39 J	µg/m^3	GP11-09 (8/15/2018)	1/2	0.31	0.39	--		N	NTX
124-48-1	Dibromochloromethane	ND	ND	µg/m^3	--	0/2	0.36	N/A	--		N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	1.2	1.8	µg/m^3	GP34-18 (8/22/2018)	2/2	--	1.8	348	N	N	BSV
100-41-4	Ethylbenzene	1.6	2.4	µg/m^3	GP11-09 (8/15/2018)	2/2	--	2.4	37	C	N	BSV
87-68-3	Hexachlorobutadiene	ND	ND	µg/m^3	--	0/2	0.83	N/A	4	C	N	ND
110-54-3	Hexane	0.93 J	1.1 J	µg/m^3	GP11-09 (8/15/2018)	2/2	--	1.1	2430	N	N	BSV
67-63-0	Isopropyl alcohol	2.5 J	43	µg/m^3	GP34-18 (8/22/2018)	2/2	--	43	695	N	N	BSV
98-82-8	Isopropyl benzene (Cumene)	0.68 J	1.2 J	µg/m^3	GP34-18 (8/22/2018)	2/2	--	1.2	1390	N	N	BSV
80-62-6	Methyl methacrylate	1.4 J	1.4 J	µg/m^3	GP11-09 (8/15/2018)	1/2	0.32	1.4	2430	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/m^3	--	0/2	0.61	N/A	360	C	N	ND
75-09-2	Methylene chloride	1.2 J	2.3	µg/m^3	GP11-09 (8/15/2018)	2/2	--	2.3	2090	N	N	BSV
91-20-3	Naphthalene	1.0 J	1.0 J	µg/m^3	GP11-09 (8/15/2018)	1/2	0.47	1	3	C	N	BSV
104-51-8	N-Butylbenzene	2.7	2.7	µg/m^3	GP11-09 (8/15/2018)	1/2	0.25	2.7	--		N	NTX
142-82-5	N-Heptane	0.50 J	1.3 J	µg/m^3	GP34-18 (8/22/2018)	2/2	--	1.3	1390	N	N	BSV
103-65-1	N-Propylbenzene	0.28 J	2.2	µg/m^3	GP11-09 (8/15/2018)	2/2	--	2.2	3480	N	N	BSV
100-42-5	Styrene	0.53 J	2.2	µg/m^3	GP11-09 (8/15/2018)	2/2	--	2.2	3480	N	N	BSV
75-65-0	tert-Butyl alcohol	1.1 J	2.2 J	µg/m^3	GP34-18 (8/22/2018)	2/2	--	2.2	104000 (5)	N	N	BSV
98-06-6	tert-Butylbenzene	ND	ND	µg/m^3	--	0/2	0.36	N/A	--		N	NTX
127-18-4	Tetrachloroethene	1.1 J	66	µg/m^3	GP34-18 (8/22/2018)	2/2	--	66	139	N	N	BSV
109-99-9	Tetrahydrofuran	0.88 J	1.7 J	µg/m^3	GP34-18 (8/22/2018)	2/2	--	1.7	6950	N	N	BSV
108-88-3	Toluene	4.5	9.8	µg/m^3	GP11-09 (8/15/2018)	2/2	--	9.8	17400	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	1.3	1.3	µg/m^3	GP34-18 (8/22/2018)	1/2	0.2	1.3	--		N	NTX
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/2	0.22	N/A	23	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/m^3	--	0/2	0.19	N/A	7	N	N	ND

Table 2.35

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Outside of OU1 Soil Vapor (Globe)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Outside of OU1 Soil Vapor (Globe)
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
75-69-4	Trichlorofluoromethane (CFC-11)	2.4	4.8	µg/m^3	GP34-18 (8/22/2018)	2/2	--	4.8	17400 (5)	N	N	BSV
76-13-1	Trifluorotrichloroethane (CFC-113)	0.62 J	0.93 J	µg/m^3	GP34-18 (8/22/2018)	2/2	--	0.93	17400	N	N	BSV
593-60-2	Vinyl bromide (Bromoethene)	ND	ND	µg/m^3	--	0/2	0.15	N/A	3	C	N	ND
75-01-4	Vinyl chloride	0.21 J	0.61	µg/m^3	GP11-09 (8/15/2018)	2/2	--	0.61	6	C	N	BSV
1330-20-7	Xylenes (total)	8.9	15.5	µg/m^3	GP11-09 (8/15/2018)	2/2	--	15.5	348	N	N	BSV

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: GP11-09, GP34-18.

(3) USEPA Vapor Intrusion Screening Levels (VISL), Resident, Target Sub-Slab and Near-source Soil Gas Concentration (Risk = 1E-06, HI = 0.1), November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Deletion Reason: Maximum detected below Screening Value (BSV)
Not Detected (ND)
No Toxicity Information or Appropriate Surrogate available (NTX)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,2-dichlorotetrafluoroethane (CFC 114)	-	dichlorodifluoromethane (CFC-12)
1,3-dichlorobenzene	-	1,2-dichlorobenzene
tert-butyl alcohol	-	sec-butyl alcohol
trichlorofluoromethane (CFC-11)	-	trifluorotrichloroethane (CFC-113)

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.36

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Indoor Air
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Indoor Air
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/m^3	--	0/2	0.16	N/A	521	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/m^3	--	0/2	0.42	N/A	0.0484	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/m^3	--	0/2	0.28	N/A	0.0209	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/m^3	--	0/2	0.11	N/A	1.75	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/m^3	--	0/2	0.13	N/A	20.9	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/m^3	--	0/2	0.73	N/A	0.209	N	N	ND
95-63-6	1,2,4-Trimethylbenzene	0.44 J	0.44 J	µg/m^3	CS-18 (10/8/2019)	1/2	0.31	0.44	6.26	N	N	BSV
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/m^3	--	0/2	0.34	N/A	0.00468	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/m^3	--	0/2	0.42	N/A	20.9	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/m^3	--	0/2	0.19	N/A	0.108	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/m^3	--	0/2	0.24	N/A	0.417	N	N	ND
76-14-2	1,2-Dichlorotetrafluoroethane (CFC 114)	ND	ND	µg/m^3	--	0/2	0.22	N/A	10.4 (5)	N	N	ND
108-67-8	1,3,5-Trimethylbenzene	ND	ND	µg/m^3	--	0/2	0.32	N/A	6.26	N	N	ND
106-99-0	1,3-Butadiene	ND	ND	µg/m^3	--	0/2	0.14	N/A	0.0936	C	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/m^3	--	0/2	0.39	N/A	20.9 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/m^3	--	0/2	0.38	N/A	0.255	C	N	ND
123-91-1	**1,4-Dioxane**	**2.2**	**2.2**	**µg/m^3**	**CS-18 (10/8/2019)**	**1/2**	**0.29**	**2.2**	**0.562**	**C**	**Y**	**ASV**
540-84-1	2,2,4-Trimethylpentane	0.36 J	0.48 J	µg/m^3	CS-18 (10/8/2019)	2/2	--	0.48	--		N	NTX
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	0.78 J	2.0 J	µg/m^3	CS-18 (10/8/2019)	2/2	--	2	521	N	N	BSV
95-49-8	2-Chlorotoluene	ND	ND	µg/m^3	--	0/2	0.33	N/A	--		N	NTX
591-78-6	2-Hexanone	ND	ND	µg/m^3	--	0/2	0.24	N/A	3.13	N	N	ND
135-98-8	2-Phenylbutane (sec-Butylbenzene)	ND	ND	µg/m^3	--	0/2	0.35	N/A	--		N	NTX
622-96-8	4-Ethyl toluene	ND	ND	µg/m^3	--	0/2	0.32	N/A	--		N	NTX
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/m^3	--	0/2	0.8	N/A	313	N	N	ND
67-64-1	Acetone	8.4 J	11 J	µg/m^3	CS-18 (10/8/2019)	2/2	--	11	3220	N	N	BSV
107-05-1	Allyl chloride	ND	ND	µg/m^3	--	0/2	0.15	N/A	0.104	N	N	ND
71-43-2	**Benzene**	**0.59 J**	**0.8**	**µg/m^3**	**CS-18 (10/8/2019)**	**2/2**	**--**	**0.8**	**0.36**	**C**	**Y**	**ASV**
100-44-7	Benzyl chloride	ND	ND	µg/m^3	--	0/2	0.4	N/A	0.0573	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/m^3	--	0/2	0.29	N/A	0.0759	C	N	ND
75-25-2	Bromoform	ND	ND	µg/m^3	--	0/2	0.5	N/A	2.55	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/m^3	--	0/2	0.12	N/A	0.521	N	N	ND
106-97-8	Butane	5.1	7.5	µg/m^3	CS-18 (10/8/2019)	2/2	--	7.5	--		N	NTX
75-15-0	Carbon disulfide	ND	ND	µg/m^3	--	0/2	0.097	N/A	73	N	N	ND

Table 2.36

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Indoor Air
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Indoor Air
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
56-23-5	**Carbon tetrachloride**	**0.46 J**	**0.48 J**	**µg/m^3**	**OA-18 (10/8/2019)**	**2/2**	**--**	**0.48**	**0.468**	**C**	**Y**	**ASV**
108-90-7	Chlorobenzene	ND	ND	µg/m^3	--	0/2	0.23	N/A	5.21	N	N	ND
75-45-6	Chlorodifluoromethane	1.5	2.2	µg/m^3	CS-18 (10/8/2019)	2/2	--	2.2	5210	N	N	BSV
75-00-3	Chloroethane	0.13 J	0.13 J	µg/m^3	CS-18 (10/8/2019)	1/2	0.092	0.13	1040	N	N	BSV
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/m^3	--	0/2	0.19	N/A	0.122	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	1.4 J	1.8 J	µg/m^3	CS-18 (10/8/2019)	2/2	--	1.8	9.39	N	N	BSV
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/m^3	--	0/2	0.24	N/A	--		N	NTX
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/2	0.34	N/A	0.702	C	N	ND
110-82-7	Cyclohexane	0.30 J	0.60 J	µg/m^3	CS-18 (10/8/2019)	2/2	--	0.6	626	N	N	BSV
99-87-6	Cymene (p-Isopropyltoluene)	ND	ND	µg/m^3	--	0/2	0.31	N/A	--		N	NTX
124-48-1	Dibromochloromethane	ND	ND	µg/m^3	--	0/2	0.36	N/A	--		N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	2.2	2.3	µg/m^3	OA-18 (10/8/2019)	2/2	--	2.3	10.4	N	N	BSV
100-41-4	Ethylbenzene	0.55 J	0.55 J	µg/m^3	CS-18 (10/8/2019)	1/2	0.3	0.55	1.12	C	N	BSV
87-68-3	Hexachlorobutadiene	ND	ND	µg/m^3	--	0/2	0.83	N/A	0.128	C	N	ND
110-54-3	Hexane	0.84 J	1.4	µg/m^3	CS-18 (10/8/2019)	2/2	--	1.4	73	N	N	BSV
67-63-0	Isopropyl alcohol	2.3 J	12	µg/m^3	CS-18 (10/8/2019)	2/2	--	12	21	N	N	BSV
98-82-8	Isopropyl benzene (Cumene)	ND	ND	µg/m^3	--	0/2	0.29	N/A	41.7	N	N	ND
80-62-6	Methyl methacrylate	ND	ND	µg/m^3	--	0/2	0.32	N/A	73	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/m^3	--	0/2	0.61	N/A	10.8	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/m^3	--	0/2	1.8 - 3.3	N/A	62.6	N	N	ND
91-20-3	Naphthalene	ND	ND	µg/m^3	--	0/2	0.47	N/A	0.0826	C	N	ND
104-51-8	N-Butylbenzene	ND	ND	µg/m^3	--	0/2	0.25	N/A	--		N	NTX
142-82-5	N-Heptane	0.38 J	0.71 J	µg/m^3	CS-18 (10/8/2019)	2/2	--	0.71	41.7	N	N	BSV
103-65-1	N-Propylbenzene	ND	ND	µg/m^3	--	0/2	0.28	N/A	104	N	N	ND
100-42-5	Styrene	ND	ND	µg/m^3	--	0/2	0.25	N/A	104	N	N	ND
75-65-0	tert-Butyl alcohol	0.47 J	0.47 J	µg/m^3	CS-18 (10/8/2019)	1/2	0.12	0.47	3130 (5)	N	N	BSV
98-06-6	tert-Butylbenzene	ND	ND	µg/m^3	--	0/2	0.36	N/A	--		N	NTX
127-18-4	Tetrachloroethene	0.36 J	0.36 J	µg/m^3	CS-18 (10/8/2019)	1/2	0.27	0.36	4.17	N	N	BSV
109-99-9	Tetrahydrofuran	0.47 J	0.47 J	µg/m^3	CS-18 (10/8/2019)	1/2	0.19	0.47	209	N	N	BSV
108-88-3	Toluene	1.7 J	3.3 J	µg/m^3	CS-18 (10/8/2019)	2/2	--	3.3	521	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/m^3	--	0/2	0.2	N/A	--		N	NTX
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/m^3	--	0/2	0.22	N/A	0.702	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/m^3	--	0/2	0.19	N/A	0.209	N	N	ND

Table 2.36

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Indoor Air
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Indoor Air
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
75-69-4	Trichlorofluoromethane (CFC-11)	1.3	1.4	µg/m^3	CS-18 (10/8/2019)	2/2	--	1.4	521 (5)	N	N	BSV
76-13-1	Trifluorotrichloroethane (CFC-113)	0.57 J	0.59 J	µg/m^3	OA-18 (10/8/2019)	2/2	--	0.59	521	N	N	BSV
593-60-2	Vinyl bromide (Bromoethene)	ND	ND	µg/m^3	--	0/2	0.15	N/A	0.0877	C	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/m^3	--	0/2	0.18	N/A	0.168	C	N	ND
1330-20-7	Xylenes (total)	0.79 J	2.53	µg/m^3	CS-18 (10/8/2019)	2/2	--	2.53	10.4	N	N	BSV

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: CS-18, OA-18

(3) USEPA Vapor Intrusion Screening Levels (VISL), Resident, Target Indoor Air Concentration, (Risk = 1E-06, HI = 0.1), November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)

Deletion Reason: Maximum detected below Screening Value (BSV)
Not Detected (ND)
No Toxicity Information or Appropriate Surrogate available (NTX)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,2-dichlorotetrafluoroethane (CFC 114)	-	dichlorodifluoromethane (CFC-12)
1,3-dichlorobenzene	-	1,2-dichlorobenzene
tert-butyl alcohol	-	sec-butyl alcohol
trichlorofluoromethane (CFC-11)	-	trifluorotrichloroethane (CFC-113)

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.37

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - Upper and Lower Aquifers
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper and Lower Aquifers
Exposure Medium: Tapwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	0.26 J	15 J	µg/L	VAS-38 (2/8/2018)	9/217	0.23 - 23	15	800	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/L	--	0/217	0.13 - 17	N/A	0.076	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/L	--	0/217	0.09 - 17	N/A	0.041	N	N	ND
75-34-3	**1,1-Dichloroethane**	**0.17 J**	**23 J**	**µg/L**	**VAS-38 (2/8/2018)**	**50/217**	**0.17 - 17**	**23**	**2.8**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	0.39 J	1.1 J	µg/L	BH17-13 (7/10/2013)	3/217	0.19 - 17	1.1	28	N	N	BSV
120-82-1	**1,2,4-Trichlorobenzene**	**1.2 J**	**1.2 J**	**µg/L**	**BH88-13 (6/24/2013)**	**1/217**	**0.26 - 17**	**1.2**	**0.4**	**N**	**Y**	**ASV**
96-12-8	**1,2-Dibromo-3-chloropropane (DBCP)**	**0.0096 NJ**	**0.0096 NJ**	**µg/L**	**MW-227 (10/4/2017)**	**1/217**	**0.0084 - 33**	**0.0096**	**0.00033**	**C**	**Y**	**ASV**
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/L	--	0/217	0.0071 - 17	N/A	0.0075	C	N	ND
95-50-1	1,2-Dichlorobenzene	0.13 J	1.4 J	µg/L	BH46-13 (7/2/2013)	12/217	0.15 - 17	1.4	30	N	N	BSV
107-06-2	**1,2-Dichloroethane**	**1.2**	**2.0 J**	**µg/L**	**BH33-13 (6/27/2013)**	**2/217**	**0.21 - 17**	**2**	**0.17**	**C**	**Y**	**ASV**
78-87-5	1,2-Dichloropropane	0.54 J	0.62 J	µg/L	BH85-13 (6/25/2013)	1/217	0.15 - 17	0.62	0.82	N	N	BSV
541-73-1	1,3-Dichlorobenzene	0.31 J	0.44 J	µg/L	BH83-13 (6/25/2013)	2/217	0.15 - 17	0.44	30 (5)	N	N	BSV
106-46-7	**1,4-Dichlorobenzene**	**0.16 J**	**5.6**	**µg/L**	**BH77-13 (6/25/2013)**	**14/217**	**0.16 - 23**	**5.6**	**0.48**	**C**	**Y**	**ASV**
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	1.0 J	4.7 J	µg/L	BH16-13 (7/10/2013)	10/217	1 - 170	4.7	560	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/L	--	0/217	0.54 - 170	N/A	3.8	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.34 J	21 J	µg/L	VAS-37 (9/18/2018)	5/217	0.42 - 170	21	630	N	N	BSV
67-64-1	Acetone	1.1 J	9.7 J	µg/L	MW-225 (10/5/2017)	18/217	1.8 - 360	9.7	1400	N	N	BSV
71-43-2	**Benzene**	**0.15 J**	**390**	**µg/L**	**MW-210B (5/15/2015)**	**45/217**	**0.13 - 17**	**390**	**0.46**	**C**	**Y**	**ASV**
75-27-4	**Bromodichloromethane**	**0.34 J**	**1.1**	**µg/L**	**VAS-34 (2/22/2018)**	**6/217**	**0.17 - 17**	**1.1**	**0.13**	**C**	**Y**	**ASV**
75-25-2	Bromoform	ND	ND	µg/L	--	0/217	0.43 - 51	N/A	3.3	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/L	--	0/217	0.42 - 28	N/A	0.75	N	N	ND
75-15-0	Carbon disulfide	0.17 J	1.2	µg/L	VAS-34 (2/20/2018)	9/217	0.28 - 19	1.2	81	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/L	--	0/217	0.26 - 17	N/A	0.46	C	N	ND
108-90-7	**Chlorobenzene**	**0.20 J**	**40**	**µg/L**	**BH77-13 (6/25/2013)**	**43/217**	**0.14 - 17**	**40**	**7.8**	**N**	**Y**	**ASV**
75-00-3	Chloroethane	0.49 J	9.4	µg/L	BH33-13 (6/27/2013)	10/217	0.41 - 55	9.4	2100	N	N	BSV
67-66-3	**Chloroform (Trichloromethane)**	**0.13 J**	**1.8**	**µg/L**	**VAS-34 (2/22/2018)**	**24/217**	**0.031 - 17**	**1.8**	**0.22**	**C**	**Y**	**ASV**
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/L	--	0/217	0.2 - 17	N/A	19	N	N	ND
156-59-2	**cis-1,2-Dichloroethene**	**0.17 J**	**1100**	**µg/L**	**MW-235 (10/18/2018)**	**147/217**	**0.16 - 14**	**1100**	**3.6**		**Y**	**ASV**
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/L	--	0/217	0.26 - 41	N/A	0.47	C	N	ND
110-82-7	Cyclohexane	0.12 J	1.0 J	µg/L	BH33-13 (6/27/2013)	10/217	0.24 - 18	1	1300	N	N	BSV
124-48-1	Dibromochloromethane	0.28 J	0.85 J	µg/L	VAS-34 (2/22/2018)	4/217	0.25 - 26	0.85	0.87	C	N	BSV
75-71-8	Dichlorodifluoromethane (CFC-12)	0.36 J	0.36 J	µg/L	BH88-13 (6/24/2013)	1/217	0.35 - 23	0.36	20	N	N	BSV
100-41-4	**Ethylbenzene**	**0.13 J**	**100**	**µg/L**	**BH33-13 (6/27/2013)**	**19/217**	**0.11 - 17**	**100**	**1.5**	**C**	**Y**	**ASV**
98-82-8	Isopropyl benzene	0.17 J	6.8	µg/L	BH33-13 (6/27/2013)	8/217	0.09 - 17	6.8	45	N	N	BSV
79-20-9	Methyl acetate	0.38 J	0.38 J	µg/L	BH19-13 (6/13/2013)	1/217	1.4 - 170	0.38	2000	N	N	BSV
108-87-2	Methyl cyclohexane	0.17 J	1.8	µg/L	MW-219 (5/13/2015)	8/217	0.33 - 22	1.8	1300 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	0.11 J	2	µg/L	BH76-13 (6/26/2013)	13/217	0.07 - 17	2	14	C	N	BSV
75-09-2	**Methylene chloride**	**2**	**15 J**	**µg/L**	**VAS-32 (1/8/2018)**	**4/217**	**0.53 - 170**	**15**	**11**	**N**	**Y**	**ASV**
100-42-5	Styrene	0.13 J	0.69 J	µg/L	BH33-13 (6/27/2013)	2/217	0.1 - 17	0.69	120	N	N	BSV
127-18-4	Tetrachloroethene	0.19 J	2.5	µg/L	BH69-13 (6/21/2013)	7/217	0.15 - 17	2.5	4.1	N	N	BSV
108-88-3	**Toluene**	**0.13 J**	**270**	**µg/L**	**BH46-13 (7/2/2013)**	**85/217**	**0.14 - 17**	**270**	**110**	**N**	**Y**	**ASV**
156-60-5	trans-1,2-Dichloroethene	0.19 J	4.3 J	µg/L	VAS-32 (1/8/2018)	17/217	0.19 - 17	4.3	36	N	N	BSV
10061-02-6	trans-1,3-Dichloropropene	0.31	0.31	µg/L	VAS-33 (1/10/2018)	1/217	0.31 - 45	0.31	0.47	C	N	BSV

Table 2.37

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - Upper and Lower Aquifers
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper and Lower Aquifers
Exposure Medium: Tapwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
79-01-6	**Trichloroethene**	**0.17 J**	**94**	**µg/L**	**BH17-13 (7/10/2013)**	**75/217**	**0.1 - 17**	**94**	**0.28**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/L	--	0/217	0.45 - 30	N/A	520	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/L	--	0/217	0.41 - 27	N/A	1000	N	N	ND
75-01-4	**Vinyl chloride**	**0.25 J**	**620**	**µg/L**	**MW-235 (10/18/2018)**	**102/217**	**0.2 - 14**	**620**	**0.019**	**C**	**Y**	**ASV**
1330-20-7	**Xylenes (total)**	**0.18 J**	**190**	**µg/L**	**BH33-13 (6/27/2013)**	**23/217**	**0.15 - 33**	**190**	**19**	**N**	**Y**	**ASV**
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/L	--	0/30	0.38 - 2.6	N/A	71	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/L	--	0/30	0.29 - 9.6	N/A	120	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/L	--	0/30	0.23 - 8.7	N/A	1.2	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/L	--	0/30	0.18 - 1.3	N/A	4.6	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/L	--	0/30	0.24 - 2.5	N/A	36	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/L	--	0/30	0.3 - 30	N/A	3.9	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/L	--	0/30	0.24 - 10	N/A	0.24	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/L	--	0/30	0.76 - 10	N/A	0.049	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/L	--	0/30	0.095 - 2.3	N/A	75	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/L	--	0/30	0.26 - 1.3	N/A	9.1	N	N	ND
91-57-6	2-Methylnaphthalene	0.13 J	1.2	µg/L	VAS-32 (1/8/2018)	5/30	0.086 - 0.53	1.2	3.6	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/L	--	0/30	0.16 - 1	N/A	93	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/L	--	0/30	0.2 - 2.5	N/A	19	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/L	--	0/30	0.27 - 2.7	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/L	--	0/30	0.18 - 0.92	N/A	93 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/L	--	0/29	0.35 - 5.5	N/A	0.1	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/L	--	0/30	0.27 - 2.7	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/L	--	0/30	2.3 - 14	N/A	0.15	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/L	--	0/30	0.21 - 2.4	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/L	--	0/30	0.2 - 1.4	N/A	140	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/L	--	0/30	0.2 - 1.5	N/A	0.37	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/L	--	0/30	0.29 - 2.6	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/L	--	0/30	0.21 - 4.4	N/A	3.8	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/L	--	0/30	0.28 - 10	N/A	--		N	ND
83-32-9	Acenaphthene	ND	ND	µg/L	--	0/30	0.042 - 0.83	N/A	53	N	N	ND
208-96-8	Acenaphthylene	ND	ND	µg/L	--	0/30	0.046 - 0.6	N/A	53	N	N	ND
98-86-2	Acetophenone	ND	ND	µg/L	--	0/30	0.32 - 1.8	N/A	190	N	N	ND
120-12-7	Anthracene	ND	ND	µg/L	--	0/30	0.084 - 0.65	N/A	180	N	N	ND
1912-24-9	Atrazine	ND	ND	µg/L	--	0/30	0.32 - 4.6	N/A	0.3	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/L	--	0/30	0.37 - 3.6	N/A	19	N	N	ND
56-55-3	Benzo(a)anthracene	ND	ND	µg/L	--	0/30	0.028 - 0.82	N/A	0.03	C	N	ND
50-32-8	Benzo(a)pyrene	ND	ND	µg/L	--	0/30	0.049 - 0.83	N/A	0.025	C	N	ND
205-99-2	Benzo(b)fluoranthene	0.17 J	0.17 J	µg/L	BH14-18 (9/17/2018)	1/30	0.038 - 0.74	0.17	0.25	C	N	BSV
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/L	--	0/30	0.044 - 0.86	N/A	12 (5)	N	N	ND

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Moraine, Ohio

Medium: Groundwater - Upper and Lower Aquifers
Exposure Medium: Tapwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
207-08-9	Benzo(k)fluoranthene	ND	ND	µg/L	--	0/30	0.043 - 0.67	N/A	2.5	C	N	ND
92-52-4	**Biphenyl (1,1-Biphenyl)**	**0.41 J**	**0.41 J**	**µg/L**	**VAS-31 (1/22/2018)**	**1/30**	**0.12 - 2.4**	**0.41**	**0.083**	**N**	**Y**	**ASV**
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/L	--	0/30	0.3 - 2.2	N/A	5.9	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/L	--	0/30	0.095 - 1.9	N/A	0.014	C	N	ND
117-81-7	**bis(2-Ethylhexyl)phthalate (DEHP)**	**2.7 J**	**160**	**µg/L**	**VAS-37 (9/18/2018)**	**4/30**	**1.6 - 2.3**	**160**	**5.6**	**C**	**Y**	**ASV**
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/L	--	0/30	0.25 - 3.2	N/A	16	C	N	ND
105-60-2	Caprolactam	0.34 J	0.49 J	µg/L	MW-225 (10/5/2017)	3/30	0.19 - 4.5	0.49	990	N	N	BSV
86-74-8	Carbazole	ND	ND	µg/L	--	0/30	0.27 - 2.4	N/A	--		N	ND
218-01-9	Chrysene	ND	ND	µg/L	--	0/30	0.048 - 0.89	N/A	25	C	N	ND
53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/L	--	0/30	0.042 - 0.73	N/A	0.025	C	N	ND
132-64-9	Dibenzofuran	ND	ND	µg/L	--	0/30	0.019 - 2.7	N/A	0.79	N	N	ND
84-66-2	Diethyl phthalate	0.68 J	0.94 J	µg/L	VAS-38 (2/9/2018)	2/30	0.57 - 18	0.94	1500	N	N	BSV
131-11-3	Dimethyl phthalate	ND	ND	µg/L	--	0/30	0.28 - 2.5	N/A	1500	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/L	--	0/30	1.6 - 8.7	N/A	90	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/L	--	0/30	0.22 - 3.9	N/A	20	N	N	ND
206-44-0	Fluoranthene	0.19	0.19	µg/L	BH14-18 (9/17/2018)	1/30	0.042 - 0.77	0.19	80	N	N	BSV
86-73-7	Fluorene	ND	ND	µg/L	--	0/30	0.039 - 0.81	N/A	29	N	N	ND
118-74-1	Hexachlorobenzene	ND	ND	µg/L	--	0/30	0.081 - 0.77	N/A	0.0098	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	--	0/30	0.26 - 2.6	N/A	0.14	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	--	0/30	0.23 - 8.4	N/A	0.041	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/L	--	0/30	0.18 - 1.9	N/A	0.33	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	ND	ND	µg/L	--	0/30	0.041 - 0.65	N/A	0.25	C	N	ND
78-59-1	Isophorone	ND	ND	µg/L	--	0/30	0.26 - 1.6	N/A	78	C	N	ND
91-20-3	**Naphthalene**	**0.24 J**	**9.8**	**µg/L**	**BH77-13 (6/25/2013)**	**10/119**	**0.06 - 11**	**9.8**	**0.17**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/L	--	0/30	0.038 - 2.5	N/A	0.14	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/L	--	0/30	0.23 - 1.2	N/A	0.011	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/L	--	0/30	0.031 - 2.1	N/A	12	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/L	--	0/30	0.26 - 15	N/A	0.041	C	N	ND
85-01-8	Phenanthrene	0.14 J	0.46	µg/L	BH14-18 (9/17/2018)	2/30	0.059 - 0.8	0.46	12 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/L	--	0/30	0.12 - 0.65	N/A	580	N	N	ND
129-00-0	Pyrene	0.24	0.24	µg/L	BH14-18 (9/17/2018)	1/30	0.04 - 0.84	0.24	12	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**34 J**	**120000**	**µg/L**	**VAS-32 (1/9/2018)**	**98/132**	**34 - 2200**	**120000**	**2000**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.60 J**	**23**	**µg/L**	**BH14-18 (9/17/2018)**	**41/132**	**0.57 - 10**	**23**	**0.78**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**0.87 J**	**820 J**	**µg/L**	**VAS-33 (1/10/2018)**	**104/132**	**0.75 - 10**	**820**	**0.052**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**84**	**5000**	**µg/L**	**VAS-44 (1/30/2018)**	**130/132**	**100 - 120**	**5000**	**380**	**N**	**Y**	**ASV**
7440-41-7	**Beryllium**	**0.31 J**	**5.4**	**µg/L**	**VAS-32 (1/9/2018)**	**35/132**	**0.31 - 5**	**5.4**	**2.5**	**N**	**Y**	**ASV**
7440-43-9	**Cadmium**	**0.22 J**	**14**	**µg/L**	**BH14-18 (9/17/2018)**	**32/132**	**0.21 - 2**	**14**	**0.92**	**N**	**Y**	**ASV**
7440-70-2	Calcium	19000	1800000	µg/L	VAS-32 (1/9/2018)	130/132	95000 - 110000	1800000	--		N	NAT
7440-47-3	**Chromium**	**0.99 J**	**610**	**µg/L**	**BH14-18 (9/17/2018)**	**73/132**	**0.98 - 30**	**610**	**0.035**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**0.20 J**	**100**	**µg/L**	**VAS-32 (1/9/2018)**	**112/132**	**0.19 - 7**	**100**	**0.6**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**1.7 J**	**1900**	**µg/L**	**BH14-18 (9/17/2018)**	**68/132**	**1.7 - 54**	**1900**	**0.035**	**N**	**Y**	**ASV**

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Exposure Medium: Tapwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
57-12-5	**Cyanide (total)**	**7.4 J**	**580**	**µg/L**	**VAS-34 (2/16/2018)**	**7/30**	**5 - 12**	**580**	**0.15**	**N**	**Y**	**ASV**
7439-89-6	**Iron**	**56 J**	**390000 J**	**µg/L**	**VAS-33 (1/10/2018)**	**129/132**	**47 - 7300**	**390000**	**1400**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**0.47 J**	**1400**	**µg/L**	**BH14-18 (9/17/2018)**	**72/132**	**0.45 - 4.3**	**1400**	**15**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	5800	450000	µg/L	VAS-32 (1/8/2018)	128/132	35000 - 41000	450000	--		N	NAT
7439-96-5	**Manganese**	**2.5 J**	**15000**	**µg/L**	**BH14-18 (9/17/2018)**	**131/132**	**220**	**15000**	**43**	**N**	**Y**	**ASV**
7439-97-6	**Mercury**	**0.13 J**	**0.56**	**µg/L**	**VAS-44 (1/25/2018)**	**9/132**	**0.13 - 2**	**0.56**	**0.063**	**N**	**Y**	**ASV**
7440-02-0	**Nickel**	**1.5 J**	**310**	**µg/L**	**VAS-32 (1/9/2018)**	**99/132**	**1.5 - 40**	**310**	**39**	**N**	**Y**	**ASV**
7440-09-7	Potassium	1300	62000	µg/L	VAS-37 (9/18/2018)	127/132	3500 - 8000	62000	--		N	NAT
7782-49-2	**Selenium**	**1.0 J**	**26**	**µg/L**	**BH1-13 (6/13/2013)**	**44/132**	**0.89 - 5**	**26**	**10**	**N**	**Y**	**ASV**
7440-22-4	Silver	0.060 J	4.1	µg/L	BH14-18 (9/17/2018)	21/132	0.053 - 5	4.1	9.4	N	N	BSV
7440-23-5	Sodium	1100	500000	µg/L	VAS-44 (1/30/2018)	128/132	37000 - 70000	500000	--		N	NAT
7440-28-0	**Thallium**	**0.20 J**	**6.7 J**	**µg/L**	**BH36-13 (7/2/2013)**	**39/132**	**0.2 - 10**	**6.7**	**0.02**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**0.83 J**	**260**	**µg/L**	**VAS-32 (1/9/2018)**	**50/132**	**0.82 - 7.5**	**260**	**8.6**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**17 J**	**5500 J**	**µg/L**	**VAS-33 (1/10/2018)**	**94/132**	**15 - 310**	**5500**	**600**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/L	--	0/51	0.048 - 0.54	N/A	0.14	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/L	--	0/51	0.054 - 0.54	N/A	0.0047	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/L	--	0/51	0.067 - 0.54	N/A	0.0047	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/L	--	0/51	0.057 - 0.54	N/A	0.0078	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/L	--	0/51	0.048 - 0.54	N/A	0.0078	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	ND	ND	µg/L	--	0/51	0.029 - 0.54	N/A	0.0078	C	N	ND
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/L	--	0/51	0.038 - 0.54	N/A	0.0078	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/L	--	0/26	0.0051 - 0.34	N/A	0.0063	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/L	--	0/26	0.0041 - 0.23	N/A	0.046	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/L	--	0/26	0.0046 - 0.32	N/A	0.23	C	N	ND
309-00-2	Aldrin	ND	ND	µg/L	--	0/26	0.0023 - 0.25	N/A	0.00092	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/L	--	0/26	0.0019 - 0.27	N/A	0.0072	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/L	--	0/26	0.0031 - 0.23	N/A	0.02	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/L	--	0/26	0.0044 - 0.34	N/A	0.025	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/L	--	0/26	0.0041 - 0.55	N/A	0.025	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/L	--	0/26	0.0022 - 0.25	N/A	0.0018	C	N	ND
959-98-8	Endosulfan I	0.032 J	0.032 J	µg/L	VAS-32 (1/8/2018)	1/26	0.0036 - 0.3	0.032	10	N	N	BSV
33213-65-9	Endosulfan II	ND	ND	µg/L	--	0/26	0.0022 - 0.29	N/A	10	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/L	--	0/26	0.0036 - 0.29	N/A	11	N	N	ND
72-20-8	Endrin	ND	ND	µg/L	--	0/26	0.0024 - 0.25	N/A	0.23	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/L	--	0/26	0.0044 - 0.34	N/A	0.23	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/L	--	0/26	0.0038 - 0.3	N/A	0.23	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/L	--	0/26	0.0024 - 0.25	N/A	0.042	C	N	ND

Table 2.37

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - Upper and Lower Aquifers
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper and Lower Aquifers
Exposure Medium: Tapwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
5103-74-2	gamma-Chlordane	ND	ND	µg/L	--	0/26	0.0048 - 0.27	N/A	0.02	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/L	--	0/26	0.0032 - 0.27	N/A	0.0014	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/L	--	0/26	0.0025 - 0.29	N/A	0.0014	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/L	--	0/26	0.0045 - 0.25	N/A	3.7	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/L	--	0/26	0.056 - 3.7	N/A	0.071	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/L	--	0/14	0.24 - 0.57	N/A	16	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/L	--	0/14	0.2 - 0.43	N/A	11	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/L	--	0/14	1.1 - 2.2	N/A	17	N	N	ND
	Petroleum Products											
--	Total Petroleum Hydrocarbons (C10-C20)	ND	ND	µg/L	--	0/3	480 - 540	N/A	--	N	N	ND
--	Total Petroleum Hydrocarbons (C20-C34)	ND	ND	µg/L	--	0/3	480 - 540	N/A	--	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from 2013 - 2018 in sampling locations: BH1-13, BH2-13, BH3-13, BH4-13, BH5-13, BH6-13, BH7-13, BH8-13, BH9-13, BH10-13, BH11-13, BH12-13, BH13-13, BH14-13, BH15-13, BH16-13, BH17-13, BH18-13, BH19-23, BH20-13, BH21-13, BH22-13, BH23-13, BH24-13, BH25-13, BH30-13, BH31-13, BH32-13, BH33-13, BH34-13, BH35-13, BH36-13, BH37-13, BH38-13, BH39-13, BH40-13, BH42-13, BH43-13, BH44-13, BH46-13, BH46B-13, BH48B-13, BH49-13, BH51-13, BH52-13, BH53-13, BH54-13, BH55-13, BH56-13, BH57-13, BH58-13, BH59-13, BH60-13, BH61-13, BH62-13, BH63-13, BH64-13, BH65-13, BH66-13, BH67-13, BH68-13, BH69-13, BH70-13, BH71-13, BH72-13, BH73-13, BH74-13, BH75-13, BH76-13, BH77-13, BH78-13, BH79-13, BH80-13, BH81-13, BH82-13, BH83-13, BH84-13, BH85-13, BH86-13, BH87-13, BH88-13, BH89-13, BH90-13, BH91-13, BH92-13, BH93-13, BH01-18, BH02-18, BH03-18, BH04-18, BH05-18, BH06-18, BH07-18, BH08-18, BH09-18, BH10-18, BH14-18, BH20-18, MW-101A, MW-202, MW203, MW204, MW208, MW209, MW210, MW212, MW215, MW216, MW217, MW219, MW225, MW227, MW229, MW230, MW233, MW235, VAS-15, VAS-22, VAS-31, VAS-32, VAS-33, VAS-34, VAS-37, VAS-38, VAS-44.

(3) Regional Screening Levels (RSL) Summary Table (TR=1E-6, HQ=0.1), Tap Water, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) The RSL for chromium is based on chromium VI.

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
N - Tentatively identified compound.

Table 2.38

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater Volatilizing to Indoor Air - Upper Aquifer
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	0.26 J	15 J	µg/L	VAS-38 (2/8/2018)	8/155	0.23 - 23	15	742	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/L	--	0/155	0.13 - 13	N/A	3.23	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/L	--	0/155	0.09 - 14	N/A	0.619	N	N	ND
75-34-3	**1,1-Dichloroethane**	**0.18 J**	**23 J**	**µg/L**	**VAS-38 (2/8/2018)**	**41/155**	**0.17 - 11**	**23**	**7.64**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	0.39 J	1.1 J	µg/L	BH17-13 (7/10/2013)	3/155	0.19 - 13	1.1	19.5	N	N	BSV
120-82-1	1,2,4-Trichlorobenzene	1.2 J	1.2 J	µg/L	BH88-13 (6/24/2013)	1/155	0.26 - 17	1.2	3.59	N	N	BSV
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	0.0096 NJ	0.0096 NJ	µg/L	MW-227 (10/4/2017)	1/155	0.0084 - 22	0.0096	0.0281	C	N	BSV
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/L	--	0/155	0.0071 - 11	N/A	0.176	C	N	ND
95-50-1	1,2-Dichlorobenzene	0.13 J	1.4 J	µg/L	BH46-13 (7/2/2013)	12/155	0.15 - 10	1.4	266	N	N	BSV
107-06-2	1,2-Dichloroethane	2.0 J	2.0 J	µg/L	BH33-13 (6/27/2013)	1/155	0.21 - 14	2	2.24	C	N	BSV
78-87-5	1,2-Dichloropropane	0.54 J	0.62 J	µg/L	BH85-13 (6/25/2013)	1/155	0.15 - 12	0.62	3.62	N	N	BSV
541-73-1	1,3-Dichlorobenzene	0.31 J	0.44 J	µg/L	BH83-13 (6/25/2013)	2/155	0.15 - 13	0.44	266 (5)	N	N	BSV
106-46-7	**1,4-Dichlorobenzene**	**0.16 J**	**5.6**	**µg/L**	**BH77-13 (6/25/2013)**	**14/155**	**0.16 - 23**	**5.6**	**2.59**	**C**	**Y**	**ASV**
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	1.0 J	4.7 J	µg/L	BH16-13 (7/10/2013)	10/155	1 - 110	4.7	224000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/L	--	0/155	0.54 - 110	N/A	821	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.34 J	21 J	µg/L	VAS-37 (9/18/2018)	3/155	0.42 - 110	21	55500	N	N	BSV
67-64-1	Acetone	1.1 J	9.7 J	µg/L	MW-225 (10/5/2017)	18/155	1.8 - 360	9.7	2250000	N	N	BSV
71-43-2	**Benzene**	**0.15 J**	**100**	**µg/L**	**BH46-13 (7/2/2013)**	**39/155**	**0.13 - 11**	**100**	**1.59**	**C**	**Y**	**ASV**
75-27-4	Bromodichloromethane	0.34 J	0.36 J	µg/L	VAS-38 (2/7/2018)	2/155	0.17 - 12	0.36	0.876	C	N	BSV
75-25-2	Bromoform	ND	ND	µg/L	--	0/155	0.43 - 51	N/A	117	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/L	--	0/155	0.42 - 28	N/A	1.74	N	N	ND
75-15-0	Carbon disulfide	0.17 J	1.2	µg/L	VAS-34 (2/20/2018)	5/155	0.28 - 19	1.2	124	N	N	BSV
56-23-5	Carbon tetrachloride	ND	ND	µg/L	--	0/155	0.26 - 17	N/A	0.415	C	N	ND
108-90-7	Chlorobenzene	0.20 J	40	µg/L	BH77-13 (6/25/2013)	42/155	0.14 - 13	40	41	N	N	BSV
75-00-3	Chloroethane	0.61 J	9.4	µg/L	BH33-13 (6/27/2013)	8/155	0.41 - 55	9.4	2300	N	N	BSV
67-66-3	**Chloroform (Trichloromethane)**	**0.32 J**	**1.3**	**µg/L**	**BH4-13 (6/14/2013)**	**8/155**	**0.031 - 12**	**1.3**	**0.814**	**C**	**Y**	**ASV**
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/L	--	0/155	0.2 - 17	N/A	26	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.17 J	1100	µg/L	MW-235 (10/18/2018)	103/155	0.16 - 2	1100	--		n	NTX
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/L	--	0/155	0.26 - 41	N/A	4.84	C	N	ND
110-82-7	Cyclohexane	0.12 J	1.0 J	µg/L	BH33-13 (6/27/2013)	10/155	0.24 - 18	1	102	N	N	BSV
124-48-1	Dibromochloromethane	0.28 J	0.32 J	µg/L	VAS-38 (2/7/2018)	2/155	0.25 - 26	0.32	--	C	N	NTX
75-71-8	Dichlorodifluoromethane (CFC-12)	0.36 J	0.36 J	µg/L	BH88-13 (6/24/2013)	1/155	0.35 - 23	0.36	0.744	N	N	BSV
100-41-4	**Ethylbenzene**	**0.27 J**	**100**	**µg/L**	**BH33-13 (6/27/2013)**	**18/155**	**0.11 - 10**	**100**	**3.49**	**C**	**Y**	**ASV**
98-82-8	Isopropyl benzene	0.17 J	6.8	µg/L	BH33-13 (6/27/2013)	8/155	0.09 - 8.4	6.8	88.7	N	N	BSV
79-20-9	Methyl acetate	0.38 J	0.38 J	µg/L	BH19-13 (6/13/2013)	1/155	1.4 - 110	0.38	--	N	N	NTX
108-87-2	Methyl cyclohexane	0.17 J	1.8	µg/L	MW-219 (5/13/2015)	8/155	0.33 - 22	1.8	102 (5)	N	N	BSV
1634-04-4	Methyl tert butyl ether (MTBE)	0.23 J	2	µg/L	BH76-13 (6/26/2013)	8/155	0.07 - 11	2	450	C	N	BSV
75-09-2	Methylene chloride	15 J	15 J	µg/L	VAS-32 (1/8/2018)	1/155	0.53 - 170	15	471	N	N	BSV
100-42-5	Styrene	0.13 J	0.69 J	µg/L	BH33-13 (6/27/2013)	2/155	0.1 - 11	0.69	928	N	N	BSV
127-18-4	Tetrachloroethene	0.31 J	2.5	µg/L	BH69-13 (6/21/2013)	6/155	0.15 - 12	2.5	5.76	N	N	BSV
108-88-3	Toluene	0.13 J	270	µg/L	BH46-13 (7/2/2013)	61/155	0.14 - 9.3	270	1920	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	0.19 J	4.3 J	µg/L	VAS-32 (1/8/2018)	12/155	0.19 - 13	4.3	--	N	N	NTX
10061-02-6	trans-1,3-Dichloropropene	0.31	0.31	µg/L	VAS-33 (1/10/2018)	1/155	0.31 - 45	0.31	4.84	C	N	BSV

Table 2.38

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater Volatilizing to Indoor Air - Upper Aquifer
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
79-01-6	**Trichloroethene**	**0.17 J**	**94**	**µg/L**	**BH17-13 (7/10/2013)**	**67/155**	**0.1 - 13**	**94**	**0.518**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/L	--	0/155	0.45 - 30	N/A	24 (5)	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/L	--	0/155	0.41 - 27	N/A	24.2	N	N	ND
75-01-4	**Vinyl chloride**	**0.25 J**	**620**	**µg/L**	**MW-235 (10/18/2018)**	**54/155**	**0.2 - 11**	**620**	**0.147**	**C**	**Y**	**ASV**
1330-20-7	**Xylenes (total)**	**0.26 J**	**190**	**µg/L**	**BH33-13 (6/27/2013)**	**21/155**	**0.15 - 10**	**190**	**38.5**	**N**	**Y**	**ASV**
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/L	--	0/26	0.38 - 2.6	N/A	--	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/L	--	0/26	0.29 - 9.6	N/A	--	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/L	--	0/26	0.23 - 8.7	N/A	--	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/L	--	0/26	0.18 - 1.3	N/A	--	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/L	--	0/26	0.24 - 2.5	N/A	--	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/L	--	0/26	0.3 - 30	N/A	--	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/L	--	0/26	0.24 - 10	N/A	--	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/L	--	0/26	0.76 - 10	N/A	--	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/L	--	0/26	0.095 - 2.3	N/A	--	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/L	--	0/26	0.26 - 1.3	N/A	--	N	N	ND
91-57-6	2-Methylnaphthalene	0.13 J	1.2	µg/L	VAS-32 (1/8/2018)	5/26	0.086 - 0.53	1.2	--	N	N	NTX
95-48-7	2-Methylphenol	ND	ND	µg/L	--	0/26	0.16 - 1	N/A	--	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/L	--	0/26	0.2 - 2.5	N/A	--	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/L	--	0/26	0.27 - 2.7	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/L	--	0/26	0.18 - 0.92	N/A	--	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/L	--	0/25	0.35 - 5.5	N/A	--	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/L	--	0/26	0.27 - 2.7	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/L	--	0/26	2.3 - 14	N/A	--	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/L	--	0/26	0.21 - 2.4	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/L	--	0/26	0.2 - 1.4	N/A	--	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/L	--	0/26	0.2 - 1.5	N/A	--	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/L	--	0/26	0.29 - 2.6	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/L	--	0/26	0.21 - 4.4	N/A	--	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/L	--	0/26	0.28 - 10	N/A	--		N	ND
83-32-9	Acenaphthene	ND	ND	µg/L	--	0/26	0.042 - 0.83	N/A	--	N	N	ND
208-96-8	Acenaphthylene	ND	ND	µg/L	--	0/26	0.046 - 0.6	N/A	--	N	N	ND
98-86-2	Acetophenone	ND	ND	µg/L	--	0/26	0.32 - 1.8	N/A	--	N	N	ND
120-12-7	Anthracene	ND	ND	µg/L	--	0/26	0.084 - 0.65	N/A	--	N	N	ND
1912-24-9	Atrazine	ND	ND	µg/L	--	0/26	0.32 - 4.6	N/A	--	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/L	--	0/26	0.37 - 3.6	N/A	--	N	N	ND
56-55-3	Benzo(a)anthracene	ND	ND	µg/L	--	0/26	0.028 - 0.82	N/A	--	C	N	ND
50-32-8	Benzo(a)pyrene	ND	ND	µg/L	--	0/26	0.049 - 0.83	N/A	--	C	N	ND
205-99-2	Benzo(b)fluoranthene	0.17 J	0.17 J	µg/L	BH14-18 (9/17/2018)	1/26	0.038 - 0.74	0.17	--	C	N	NVOC
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/L	--	0/26	0.044 - 0.86	N/A	--	N	N	ND

Table 2.38

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater Volatilizing to Indoor Air - Upper Aquifer
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
207-08-9	Benzo(k)fluoranthene	ND	ND	µg/L	--	0/26	0.043 - 0.67	N/A	--	C	N	ND
92-52-4	Biphenyl (1,1-Biphenyl)	0.41 J	0.41 J	µg/L	VAS-31 (1/22/2018)	1/26	0.12 - 2.4	0.41	3.31	N	N	BSV
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/L	--	0/26	0.3 - 2.2	N/A	--	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/L	--	0/26	0.095 - 1.9	N/A	--	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	2.7 J	160	µg/L	VAS-37 (9/18/2018)	4/26	1.6 - 2.3	160	--	C	N	NVOC
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/L	--	0/26	0.25 - 3.2	N/A	--	C	N	ND
105-60-2	Caprolactam	0.34 J	0.49 J	µg/L	MW-225 (10/5/2017)	2/26	0.19 - 4.5	0.49	--	N	N	NVOC
86-74-8	Carbazole	ND	ND	µg/L	--	0/26	0.27 - 2.4	N/A	--		N	ND
218-01-9	Chrysene	ND	ND	µg/L	--	0/26	0.048 - 0.89	N/A	--	C	N	ND
53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/L	--	0/26	0.042 - 0.73	N/A	--	C	N	ND
132-64-9	Dibenzofuran	ND	ND	µg/L	--	0/26	0.019 - 2.7	N/A	--	N	N	ND
84-66-2	Diethyl phthalate	0.68 J	0.94 J	µg/L	VAS-38 (2/9/2018)	2/26	0.57 - 18	0.94	--	N	N	NVOC
131-11-3	Dimethyl phthalate	ND	ND	µg/L	--	0/26	0.28 - 2.5	N/A	--	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/L	--	0/26	1.6 - 8.7	N/A	--	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/L	--	0/26	0.22 - 3.9	N/A	--	N	N	ND
206-44-0	Fluoranthene	0.19	0.19	µg/L	BH14-18 (9/17/2018)	1/26	0.042 - 0.77	0.19	--	N	N	NVOC
86-73-7	Fluorene	ND	ND	µg/L	--	0/26	0.039 - 0.81	N/A	--	N	N	ND
118-74-1	Hexachlorobenzene	ND	ND	µg/L	--	0/26	0.081 - 0.77	N/A	--	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	--	0/26	0.26 - 2.6	N/A	--	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	--	0/26	0.23 - 8.4	N/A	--	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/L	--	0/26	0.18 - 1.9	N/A	--	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	ND	ND	µg/L	--	0/26	0.041 - 0.65	N/A	--	C	N	ND
78-59-1	Isophorone	ND	ND	µg/L	--	0/26	0.26 - 1.6	N/A	--	C	N	ND
91-20-3	**Naphthalene**	**0.24 J**	**9.8**	**µg/L**	**BH77-13 (6/25/2013)**	**10/115**	**0.06 - 11**	**9.8**	**4.59**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/L	--	0/26	0.038 - 2.5	N/A	--	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/L	--	0/26	0.23 - 1.2	N/A	--	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/L	--	0/26	0.031 - 2.1	N/A	--	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/L	--	0/26	0.26 - 15	N/A	--	C	N	ND
85-01-8	Phenanthrene	0.14 J	0.46	µg/L	BH14-18 (9/17/2018)	2/26	0.059 - 0.8	0.46	--	N	N	NVOC
108-95-2	Phenol	ND	ND	µg/L	--	0/26	0.12 - 0.65	N/A	--	N	N	ND
129-00-0	Pyrene	0.24	0.24	µg/L	BH14-18 (9/17/2018)	1/26	0.04 - 0.84	0.24	--	N	N	NTX
	Metals											
7429-90-5	Aluminum	39 J	62000	µg/L	VAS-32 (1/8/2018)	47/75	34 - 2200	62000	--	N	N	NVOC
7440-36-0	Antimony	0.66 J	23	µg/L	BH14-18 (9/17/2018)	21/75	0.57 - 10	23	--	N	N	NVOC
7440-38-2	Arsenic	0.87 J	820 J	µg/L	VAS-33 (1/10/2018)	50/75	0.75 - 10	820	--	C	N	NVOC
7440-39-3	Barium	97	5000	µg/L	VAS-44 (1/30/2018)	75/75	--	5000	--	N	N	NVOC
7440-41-7	Beryllium	0.31 J	4.3 J	µg/L	VAS-33 (1/10/2018)	23/75	0.31 - 5	4.3	--	N	N	NVOC
7440-43-9	Cadmium	0.22 J	14	µg/L	BH14-18 (9/17/2018)	18/75	0.21 - 2	14	--	N	N	NVOC
7440-70-2	Calcium	19000	1400000	µg/L	VAS-32 (1/8/2018)	75/75	--	1400000	--		N	NVOC
7440-47-3	Chromium	1.0 J	610	µg/L	BH14-18 (9/17/2018)	38/75	0.98 - 30	610	--	C	N	NVOC
7440-48-4	Cobalt	0.30 J	72 J	µg/L	VAS-33 (1/10/2018)	58/75	0.19 - 7	72	--	N	N	NVOC
7440-50-8	Copper	1.7 J	1900	µg/L	BH14-18 (9/17/2018)	39/75	1.7 - 52	1900	--	N	N	NVOC

Table 2.38

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater Volatilizing to Indoor Air - Upper Aquifer
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
57-12-5	**Cyanide (total)**	**7.4 J**	**580**	**µg/L**	**VAS-34 (2/16/2018)**	**7/26**	**5 - 12**	**580**	**20.1**	**N**	**Y**	**ASV**
7439-89-6	Iron	56 J	390000 J	µg/L	VAS-33 (1/10/2018)	72/75	47 - 7300	390000	--	N	N	NVOC
7439-92-1	Lead	0.50 J	1400	µg/L	BH14-18 (9/17/2018)	38/75	0.45 - 4.3	1400	--	C	N	NVOC
7439-95-4	Magnesium	5800	450000	µg/L	VAS-32 (1/8/2018)	75/75	--	450000	--		N	NVOC
7439-96-5	Manganese	2.5 J	15000	µg/L	BH14-18 (9/17/2018)	74/75	220	15000	--	N	N	NVOC
7439-97-6	**Mercury**	**0.24**	**0.56**	**µg/L**	**VAS-44 (1/25/2018)**	**4/75**	**0.13 - 2**	**0.56**	**0.0889**	**N**	**Y**	**ASV**
7440-02-0	Nickel	1.5 J	300	µg/L	BH14-18 (9/17/2018)	60/75	1.5 - 40	300	--	N	N	NVOC
7440-09-7	Potassium	1300	62000	µg/L	VAS-37 (9/18/2018)	74/75	3500	62000	--		N	NOVC
7782-49-2	Selenium	1.0 J	26	µg/L	BH1-13 (6/13/2013)	36/75	0.89 - 5	26	--	N	N	NVOC
7440-22-4	Silver	0.060 J	4.1	µg/L	BH14-18 (9/17/2018)	14/75	0.053 - 5	4.1	--	N	N	NVOC
7440-23-5	Sodium	1100	500000	µg/L	VAS-44 (1/30/2018)	75/75	--	500000	--		N	NNOV
7440-28-0	Thallium	0.20 J	6.7 J	µg/L	BH36-13 (7/2/2013)	29/75	0.2 - 10	6.7	--	N	N	NVOC
7440-62-2	Vanadium	0.83 J	160	µg/L	VAS-32 (1/8/2018)	29/75	0.82 - 7.5	160	--	N	N	NVOC
7440-66-6	Zinc	17 J	5500 J	µg/L	VAS-33 (1/10/2018)	41/75	15 - 170	5500	--	N	N	NVOC
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/L	--	0/47	0.048 - 0.54	N/A	--	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/L	--	0/47	0.054 - 0.54	N/A	--	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/L	--	0/47	0.067 - 0.54	N/A	--	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/L	--	0/47	0.057 - 0.54	N/A	--	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/L	--	0/47	0.048 - 0.54	N/A	--	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	ND	ND	µg/L	--	0/47	0.029 - 0.54	N/A	--	C	N	ND
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/L	--	0/47	0.038 - 0.54	N/A	--	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/L	--	0/22	0.0051 - 0.28	N/A	--	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/L	--	0/22	0.0041 - 0.23	N/A	--	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/L	--	0/22	0.0046 - 0.26	N/A	--	C	N	ND
309-00-2	Aldrin	ND	ND	µg/L	--	0/22	0.0023 - 0.13	N/A	--	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/L	--	0/22	0.0019 - 0.11	N/A	--	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/L	--	0/22	0.0031 - 0.17	N/A	--	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/L	--	0/22	0.0044 - 0.24	N/A	--	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/L	--	0/22	0.0041 - 0.23	N/A	--	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/L	--	0/22	0.0022 - 0.12	N/A	--	C	N	ND
959-98-8	Endosulfan I	0.032 J	0.032 J	µg/L	VAS-32 (1/8/2018)	1/22	0.0036 - 0.2	0.032	--	N	N	NTX
33213-65-9	Endosulfan II	ND	ND	µg/L	--	0/22	0.0022 - 0.12	N/A	--	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/L	--	0/22	0.0036 - 0.2	N/A	--	N	N	ND
72-20-8	Endrin	ND	ND	µg/L	--	0/22	0.0024 - 0.13	N/A	--	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/L	--	0/22	0.0044 - 0.24	N/A	--	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/L	--	0/22	0.0038 - 0.21	N/A	--	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/L	--	0/22	0.0024 - 0.13	N/A	--	C	N	ND

Table 2.38

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater Volatilizing to Indoor Air - Upper Aquifer
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Indoor Air

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
5103-74-2	gamma-Chlordane	ND	ND	µg/L	--	0/22	0.0048 - 0.27	N/A	--	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/L	--	0/22	0.0032 - 0.18	N/A	--	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/L	--	0/22	0.0025 - 0.14	N/A	--	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/L	--	0/22	0.0045 - 0.25	N/A	--	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/L	--	0/22	0.056 - 3.1	N/A	--	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/L	--	0/11	0.24 - 0.57	N/A	--	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/L	--	0/11	0.2 - 0.43	N/A	--	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/L	--	0/11	1.1 - 2.2	N/A	--	N	N	ND
	Petroleum Products											
--	Total Petroleum Hydrocarbons (C10-C20)	ND	ND	µg/L	--	0/3	480 - 540	N/A	--	N	N	ND
--	Total Petroleum Hydrocarbons (C20-C34)	ND	ND	µg/L	--	0/3	480 - 540	N/A	--	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from 2013 - 2018 in sampling locations: BH1-13, BH2-13, BH3-13, BH4-13, BH5-13, BH6-13, BH7-13, BH8-13, BH9-13, BH10-13, BH11-13, BH12-13, BH13-13, BH14-13, BH15-13, BH16-13, BH17-13, BH18-13, BH19-23, BH20-13, BH21-13, BH22-13, BH23-13, BH24-13, BH25-13, BH30-13, BH31-13, BH32-13, BH33-13, BH34-13, BH35-13, BH36-13, BH37-13, BH38-13, BH39-13, BH40-13, BH42-13, BH43-13, BH44-13, BH46-13, BH46B-13, BH48B-13, BH49-13, BH51-13, BH52-13, BH53-13, BH54-13, BH55-13, BH56-13, BH57-13, BH58-13, BH59-13, BH60-13, BH61-13, BH62-13, BH63-13, BH64-13, BH65-13, BH66-13, BH67-13, BH68-13, BH69-13, BH70-13, BH71-13, BH72-13, BH73-13, BH74-13, BH75-13, BH76-13, BH77-13, BH78-13, BH79-13, BH80-13, BH81-13, BH82-13, BH83-13, BH84-13, BH85-13, BH86-13, BH87-13, BH88-13, BH89-13, BH90-13, BH91-13, BH92-13, BH93-13, BH01-18, BH02-18, BH03-18, BH04-18, BH05-18, BH06-18, BH07-18, BH08-18, BH09-18, BH10-18, BH14-18, BH20-18, MW-101A, MW-202, MW203, MW204, MW208, MW209, MW210, MW212, MW215A, MW217, MW219, MW225, MW227, MW229, MW230, MW233, MW235, VAS-31, VAS-32, VAS-33, VAS-34, VAS-37, VAS-38, VAS-44.

(3) USEPA Vapor Intrusion Screening Levels (VISL), Resident, Target Groundwater Concentration (Risk = 1E-06, HI = 0.1), November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Deletion Reason: Maximum detected below Screening Value (BSV)
Chemical Not considered to be a Volatile (NVOC)
Not Detected (ND)
No Toxicity Information or Appropriate Surrogate available (NTX)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
trichlorofluoromethane (CFC-11)	-	trifluorotrichloroethane (CFC-113)
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
N - Tentatively identified compound.

Table 2.39

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - Floodplain
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Floodplain
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	0.28 J	3.7	µg/L	BH03-18 (5/7/2018)	6/21	0.23 - 1	3.7	800	N	N	BSV
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/L	--	0/21	0.13 - 1	N/A	0.076	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/L	--	0/21	0.09 - 1	N/A	0.041	N	N	ND
75-34-3	1,1-Dichloroethane	0.23 J	1.8	µg/L	BH03-18 (5/7/2018)	5/21	0.17 - 1	1.8	2.8	C	N	BSV
75-35-4	1,1-Dichloroethene	ND	ND	µg/L	--	0/21	0.19 - 1	N/A	28	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	0.26 J	0.26 J	µg/L	VAS-39 (2/20/2019)	1/21	0.26 - 1	0.26	0.4	N	N	BSV
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/L	--	0/21	0.0084 - 2	N/A	0.00033	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/L	--	0/21	0.0071 - 1	N/A	0.0075	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/L	--	0/21	0.15 - 1	N/A	30	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/L	--	0/21	0.21 - 1	N/A	0.17	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/L	--	0/21	0.15 - 1	N/A	0.82	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/L	--	0/21	0.15 - 1	N/A	30 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/L	--	0/21	0.16 - 1	N/A	0.48	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ND	ND	µg/L	--	0/21	1 - 10	N/A	560	N	N	ND
591-78-6	2-Hexanone	ND	ND	µg/L	--	0/21	0.54 - 10	N/A	3.8	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/L	--	0/21	0.42 - 10	N/A	630	N	N	ND
67-64-1	Acetone	3.0 J	3.0 J	µg/L	MW-207 (10/4/2017)	1/21	1.8 - 290	3	1400	N	N	BSV
71-43-2	Benzene	0.14 J	0.22 J	µg/L	VAS-39 (2/20/2019)	3/21	0.13 - 1	0.22	0.46	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/L	--	0/21	0.17 - 1	N/A	0.13	C	N	ND
75-25-2	Bromoform	ND	ND	µg/L	--	0/21	0.43 - 1	N/A	3.3	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/L	--	0/21	0.42 - 1	N/A	0.75	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/L	--	0/21	0.28 - 1	N/A	81	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/L	--	0/21	0.26 - 1	N/A	0.46	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/L	--	0/21	0.14 - 1	N/A	7.8	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/L	--	0/21	0.41 - 1	N/A	2100	N	N	ND
67-66-3	**Chloroform (Trichloromethane)**	**0.20 J**	**0.45 J**	**µg/L**	**VAS-39 (1/23/2019)**	**2/21**	**0.13 - 1**	**0.45**	**0.22**	**C**	**Y**	**ASV**
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/L	--	0/21	0.2 - 1	N/A	19	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.20 J	1.7	µg/L	BH03-18 (5/7/2018)	3/21	0.16 - 1	1.7	3.6		N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/L	--	0/21	0.26 - 1	N/A	0.47	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/L	--	0/21	0.24 - 1	N/A	1300	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/L	--	0/21	0.25 - 1	N/A	0.87	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/L	--	0/21	0.35 - 1	N/A	20	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/L	--	0/21	0.11 - 1	N/A	1.5	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/L	--	0/21	0.09 - 1	N/A	45	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/L	--	0/21	1.4 - 10	N/A	2000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/L	--	0/21	0.33 - 1	N/A	1300 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/L	--	0/21	0.07 - 1	N/A	14	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/L	--	0/21	0.53 - 2.6	N/A	11	N	N	ND
100-42-5	Styrene	ND	ND	µg/L	--	0/21	0.1 - 1	N/A	120	N	N	ND
127-18-4	Tetrachloroethene	0.31 J	0.79 J	µg/L	BH03-18 (5/7/2018)	6/21	0.15 - 1	0.79	4.1	N	N	BSV
108-88-3	Toluene	0.22 J	1.1	µg/L	VAS-39 (2/5/2019)	13/21	0.23 - 1	1.1	110	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	0.19 J	0.19 J	µg/L	VAS-39 (2/20/2019)	1/21	0.19 - 1	0.19	36	N	N	BSV
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/L	--	0/21	0.31 - 1	N/A	0.47	C	N	ND

Table 2.39

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - Floodplain
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Floodplain
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
79-01-6	**Trichloroethene**	**0.14 J**	**12**	**µg/L**	**BH03-18 (5/7/2018)**	**13/21**	**0.1 - 0.52**	**12**	**0.28**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/L	--	0/21	0.45 - 1	N/A	520	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/L	--	0/21	0.41 - 1	N/A	1000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/L	--	0/21	0.2 - 1	N/A	0.019	C	N	ND
1330-20-7	Xylenes (total)	0.15 J	0.15 J	µg/L	VAS-39 (1/22/2019)	1/21	0.15 - 2	0.15	19	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/L	--	0/5	0.39 - 0.53	N/A	71	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/L	--	0/5	0.29 - 1.9	N/A	120	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/L	--	0/5	0.23 - 1.7	N/A	1.2	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/L	--	0/5	0.18 - 0.25	N/A	4.6	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/L	--	0/5	0.24 - 0.5	N/A	36	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/L	--	0/5	0.31 - 6	N/A	3.9	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/L	--	0/5	0.24 - 2	N/A	0.24	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/L	--	0/5	0.78 - 2.1	N/A	0.049	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/L	--	0/5	0.097 - 0.47	N/A	75	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/L	--	0/5	0.26 - 0.3	N/A	9.1	N	N	ND
91-57-6	2-Methylnaphthalene	ND	ND	µg/L	--	0/5	0.088 - 0.11	N/A	3.6	N	N	ND
95-48-7	2-Methylphenol	ND	ND	µg/L	--	0/5	0.17 - 0.2	N/A	93	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/L	--	0/5	0.2 - 0.5	N/A	19	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/L	--	0/5	0.27 - 0.55	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/L	--	0/5	0.18 - 0.83	N/A	93 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/L	--	0/5	0.36 - 1.1	N/A	0.1	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/L	--	0/5	0.27 - 0.55	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/L	--	0/5	2.3 - 2.7	N/A	0.15	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/L	--	0/5	0.21 - 0.48	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/L	--	0/5	0.2 - 0.29	N/A	140	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/L	--	0/5	0.2 - 0.31	N/A	0.37	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/L	--	0/5	0.29 - 0.53	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/L	--	0/5	0.21 - 0.89	N/A	3.8	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/L	--	0/5	0.28 - 2.1	N/A	--		N	ND
83-32-9	Acenaphthene	ND	ND	µg/L	--	0/5	0.043 - 0.17	N/A	53	N	N	ND
208-96-8	Acenaphthylene	ND	ND	µg/L	--	0/5	0.047 - 0.12	N/A	53	N	N	ND
98-86-2	Acetophenone	ND	ND	µg/L	--	0/5	0.33 - 0.36	N/A	190	N	N	ND
120-12-7	Anthracene	ND	ND	µg/L	--	0/5	0.085 - 0.13	N/A	180	N	N	ND
1912-24-9	Atrazine	ND	ND	µg/L	--	0/5	0.33 - 0.92	N/A	0.3	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/L	--	0/5	0.38 - 0.74	N/A	19	N	N	ND
56-55-3	**Benzo(a)anthracene**	**0.24**	**0.24**	**µg/L**	**VAS-39 (1/22/2019)**	**1/5**	**0.029 - 0.17**	**0.24**	**0.03**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**0.36**	**0.36**	**µg/L**	**VAS-39 (1/22/2019)**	**1/5**	**0.05 - 0.17**	**0.36**	**0.025**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**0.42**	**0.42**	**µg/L**	**VAS-39 (1/22/2019)**	**1/5**	**0.038 - 0.15**	**0.42**	**0.25**	**C**	**Y**	**ASV**
191-24-2	Benzo(g,h,i)perylene	0.31	0.31	µg/L	VAS-39 (1/22/2019)	1/5	0.045 - 0.17	0.31	12 (5)	N	N	BSV

Table 2.39

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - Floodplain
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Floodplain
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
207-08-9	Benzo(k)fluoranthene	0.16 J	0.16 J	µg/L	VAS-39 (1/22/2019)	1/5	0.043 - 0.14	0.16	2.5	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/L	--	0/5	0.13 - 0.48	N/A	0.083	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/L	--	0/5	0.31 - 0.44	N/A	5.9	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/L	--	0/5	0.097 - 0.39	N/A	0.014	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ND	ND	µg/L	--	0/5	1.7 - 2.2	N/A	5.6	C	N	ND
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/L	--	0/5	0.25 - 0.65	N/A	16	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/L	--	0/5	0.19 - 0.91	N/A	990	N	N	ND
86-74-8	Carbazole	ND	ND	µg/L	--	0/5	0.27 - 0.48	N/A	--		N	ND
218-01-9	Chrysene	0.22	0.22	µg/L	VAS-39 (1/22/2019)	1/5	0.049 - 0.18	0.22	25	C	N	BSV
53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/L	--	0/5	0.043 - 0.15	N/A	0.025	C	N	ND
132-64-9	Dibenzofuran	ND	ND	µg/L	--	0/5	0.019 - 0.54	N/A	0.79	N	N	ND
84-66-2	Diethyl phthalate	ND	ND	µg/L	--	0/5	0.58 - 3.7	N/A	1500	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/L	--	0/5	0.28 - 0.5	N/A	1500	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/L	--	0/5	1.7 - 1.8	N/A	90	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/L	--	0/5	0.22 - 0.8	N/A	20	N	N	ND
206-44-0	Fluoranthene	0.45	0.45	µg/L	VAS-39 (1/22/2019)	1/5	0.043 - 0.16	0.45	80	N	N	BSV
86-73-7	Fluorene	ND	ND	µg/L	--	0/5	0.039 - 0.16	N/A	29	N	N	ND
118-74-1	Hexachlorobenzene	ND	ND	µg/L	--	0/5	0.083 - 0.16	N/A	0.0098	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	--	0/5	0.26 - 0.53	N/A	0.14	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	--	0/5	0.23 - 1.7	N/A	0.041	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/L	--	0/5	0.18 - 0.38	N/A	0.33	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**0.32**	**0.32**	**µg/L**	**VAS-39 (1/22/2019)**	**1/5**	**0.042 - 0.13**	**0.32**	**0.25**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/L	--	0/5	0.26 - 0.31	N/A	78	C	N	ND
91-20-3	Naphthalene	ND	ND	µg/L	--	0/5	0.061 - 0.11	N/A	0.17	C	N	ND
98-95-3	Nitrobenzene	ND	ND	µg/L	--	0/5	0.039 - 0.5	N/A	0.14	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/L	--	0/5	0.23 - 0.25	N/A	0.011	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/L	--	0/5	0.3 - 0.43	N/A	12	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/L	--	0/5	0.26 - 3	N/A	0.041	C	N	ND
85-01-8	Phenanthrene	0.26	0.26	µg/L	VAS-39 (1/22/2019)	1/5	0.06 - 0.16	0.26	12 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/L	--	0/5	0.12 - 0.62	N/A	580	N	N	ND
129-00-0	Pyrene	0.37	0.37	µg/L	VAS-39 (1/22/2019)	1/5	0.041 - 0.17	0.37	12	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**55**	**170000**	**µg/L**	**VAS-39 (1/29/2019)**	**18/18**	**--**	**170000**	**2000**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**0.65 J**	**5.7**	**µg/L**	**VAS-39 (1/29/2019)**	**6/18**	**0.57**	**5.7**	**0.78**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**0.95 J**	**360**	**µg/L**	**VAS-39 (1/23/2019)**	**14/18**	**0.75 - 2.9**	**360**	**0.052**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**110**	**2500**	**µg/L**	**VAS-39 (1/29/2019)**	**18/18**	**--**	**2500**	**380**	**N**	**Y**	**ASV**
7440-41-7	**Beryllium**	**0.32 J**	**12**	**µg/L**	**VAS-39 (1/29/2019)**	**9/18**	**0.31 - 0.52**	**12**	**2.5**	**N**	**Y**	**ASV**
7440-43-9	**Cadmium**	**0.21 J**	**4.4**	**µg/L**	**VAS-39 (1/29/2019)**	**7/18**	**0.21**	**4.4**	**0.92**	**N**	**Y**	**ASV**
7440-70-2	Calcium	75000	3000000	µg/L	VAS-39 (1/29/2019)	18/18	--	3000000	--		N	NAT
7440-47-3	**Chromium**	**1.6 J**	**510**	**µg/L**	**VAS-39 (1/29/2019)**	**12/18**	**0.98 - 30**	**510**	**0.035**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**0.20 J**	**190**	**µg/L**	**VAS-39 (1/29/2019)**	**17/18**	**2.8**	**190**	**0.6**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**1.9 J**	**420**	**µg/L**	**VAS-39 (1/23/2019)**	**16/18**	**1.7 - 52**	**420**	**0.035**	**N**	**Y**	**ASV**

Table 2.39

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - Floodplain
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Floodplain
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
57-12-5	Cyanide (total)	ND	ND	µg/L	--	0/6	5 - 6	N/A	0.15	N	N	ND
7439-89-6	**Iron**	**62 J**	**500000**	**µg/L**	**VAS-39 (1/23/2019)**	**16/18**	**47 - 7300**	**500000**	**1400**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**1**	**330**	**µg/L**	**VAS-39 (1/29/2019)**	**14/18**	**0.45 - 3.8**	**330**	**15**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	23000	1100000	µg/L	VAS-39 (1/29/2019)	18/18	--	1100000	--		N	NAT
7439-96-5	**Manganese**	**22**	**7400**	**µg/L**	**VAS-39 (1/29/2019)**	**17/18**	**220**	**7400**	**43**	**N**	**Y**	**ASV**
7439-97-6	**Mercury**	**0.27**	**0.35**	**µg/L**	**VAS-39 (1/23/2019)**	**2/18**	**0.13**	**0.35**	**0.063**	**N**	**Y**	**ASV**
7440-02-0	**Nickel**	**1.6 J**	**480**	**µg/L**	**VAS-39 (1/29/2019)**	**14/18**	**1.5 - 32**	**480**	**39**	**N**	**Y**	**ASV**
7440-09-7	Potassium	1300	52000	µg/L	VAS-39 (1/29/2019)	17/18	3500	52000	--		N	NAT
7782-49-2	**Selenium**	**0.95 J**	**19**	**µg/L**	**VAS-39 (1/23/2019)**	**10/18**	**0.89 - 2.9**	**19**	**10**	**N**	**Y**	**ASV**
7440-22-4	Silver	0.065 J	0.96 J	µg/L	VAS-39 (1/23/2019)	6/18	0.053 - 0.11	0.96	9.4	N	N	BSV
7440-23-5	Sodium	11000	120000	µg/L	MW-226 (10/4/2017)	18/18	--	120000	--		N	NAT
7440-28-0	**Thallium**	**0.22 J**	**5.4**	**µg/L**	**VAS-39 (1/29/2019)**	**9/18**	**0.2**	**5.4**	**0.02**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**0.91 J**	**470**	**µg/L**	**VAS-39 (1/29/2019)**	**15/18**	**0.82 - 7.5**	**470**	**8.6**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**16 J**	**4100**	**µg/L**	**VAS-39 (1/29/2019)**	**14/18**	**15 - 170**	**4100**	**600**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/L	--	0/5	0.048 - 0.056	N/A	0.14	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/L	--	0/5	0.055 - 0.095	N/A	0.0047	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/L	--	0/5	0.067 - 0.074	N/A	0.0047	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/L	--	0/5	0.057 - 0.076	N/A	0.0078	C	N	ND
12672-29-6	**Aroclor-1248 (PCB-1248)**	**0.39**	**0.39**	**µg/L**	**VAS-39 (1/22/2019)**	**1/5**	**0.048 - 0.053**	**0.39**	**0.0078**	**C**	**Y**	**ASV**
11097-69-1	Aroclor-1254 (PCB-1254)	ND	ND	µg/L	--	0/5	0.029 - 0.04	N/A	0.0078	C	N	ND
11096-82-5	**Aroclor-1260 (PCB-1260)**	**0.082 J**	**0.082 J**	**µg/L**	**VAS-39 (1/22/2019)**	**1/5**	**0.038 - 0.046**	**0.082**	**0.0078**	**C**	**Y**	**ASV**
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/L	--	0/5	0.0051 - 0.019	N/A	0.0063	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/L	--	0/5	0.0041 - 0.012	N/A	0.046	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/L	--	0/5	0.0046 - 0.018	N/A	0.23	C	N	ND
309-00-2	Aldrin	ND	ND	µg/L	--	0/5	0.0023 - 0.013	N/A	0.00092	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/L	--	0/5	0.0019 - 0.014	N/A	0.0072	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/L	--	0/5	0.0031 - 0.012	N/A	0.02	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/L	--	0/5	0.0044 - 0.019	N/A	0.025	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/L	--	0/5	0.0041 - 0.03	N/A	0.025	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/L	--	0/5	0.0022 - 0.013	N/A	0.0018	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/L	--	0/5	0.0036 - 0.016	N/A	10	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/L	--	0/5	0.0022 - 0.015	N/A	10	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/L	--	0/5	0.0036 - 0.015	N/A	11	N	N	ND
72-20-8	Endrin	ND	ND	µg/L	--	0/5	0.0024 - 0.013	N/A	0.23	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/L	--	0/5	0.0044 - 0.019	N/A	0.23	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/L	--	0/5	0.0038 - 0.016	N/A	0.23	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/L	--	0/5	0.0024 - 0.013	N/A	0.042	C	N	ND

Table 2.39

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - Floodplain
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Floodplain
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
5103-74-2	gamma-Chlordane	ND	ND	µg/L	--	0/5	0.0048 - 0.013	N/A	0.02	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/L	--	0/5	0.0032 - 0.014	N/A	0.0014	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/L	--	0/5	0.0025 - 0.015	N/A	0.0014	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/L	--	0/5	0.0045 - 0.013	N/A	3.7	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/L	--	0/5	0.056 - 0.2	N/A	0.071	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/L	--	0/3	0.24	N/A	16	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/L	--	0/3	0.2	N/A	11	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/L	--	0/3	1.1	N/A	17	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from 2013 - 2018 in sampling locations: BH01-18, BH02-18, BH03-18, BH07-18, MW-102, MW-103, MW-201, MW-206, MW-207, MW-226, VAS-39.

(3) Regional Screening Levels (RSL) Summary Table (TR=1E-6, HQ=0.1), Tap Water, November 2019.

(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) The RSL for chromium is based on chromium VI.

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
N - Tentatively identified compound.

Table 2.40

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - OU1 Upper Aquifer (EU1 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/L	--	0/12	0.23 - 5	N/A	800	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/L	--	0/12	0.13 - 5	N/A	0.076	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/L	--	0/12	0.09 - 5	N/A	0.041	N	N	ND
75-34-3	**1,1-Dichloroethane**	**0.43 J**	**5.2**	**µg/L**	**BH92-13 (7/9/2013)**	**6/12**	**0.17 - 5**	**5.2**	**2.8**	**C**	**Y**	**ASV**
75-35-4	1,1-Dichloroethene	ND	ND	µg/L	--	0/12	0.19 - 5	N/A	28	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/L	--	0/12	0.26 - 5	N/A	0.4	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/L	--	0/12	0.0086 - 10	N/A	0.00033	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/L	--	0/12	0.0087 - 5	N/A	0.0075	C	N	ND
95-50-1	1,2-Dichlorobenzene	1.1 J	1.1 J	µg/L	VAS-37 (9/18/2018)	1/12	0.15 - 5	1.1 J	30	N	N	BSV
107-06-2	1,2-Dichloroethane	ND	ND	µg/L	--	0/12	0.21 - 5	N/A	0.17	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/L	--	0/12	0.15 - 5	N/A	0.82	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/L	--	0/12	0.15 - 5	N/A	30 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/L	--	0/12	0.16 - 5	N/A	0.48	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	1.4 J	2.3 J	µg/L	BH93-13 (7/9/2013)	2/12	1 - 50	2.3 J	560	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/L	--	0/12	0.54 - 50	N/A	3.8	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	21 J	21 J	µg/L	VAS-37 (9/18/2018)	1/12	0.42 - 50	21 J	630	N	N	BSV
67-64-1	Acetone	1.4 J	3.6 J	µg/L	BH92-13 (7/9/2013)	2/12	1.8 - 50	3.6 J	1400	N	N	BSV
71-43-2	**Benzene**	**0.55 J**	**2.4 J**	**µg/L**	**VAS-11 (12/8/2008)**	**4/12**	**0.13 - 1**	**2.4 J**	**0.46**	**C**	**Y**	**ASV**
75-27-4	**Bromodichloromethane**	**0.36 J**	**0.36 J**	**µg/L**	**VAS-38 (2/7/2018)**	**1/12**	**0.17 - 5**	**0.36 J**	**0.13**	**C**	**Y**	**ASV**
75-25-2	Bromoform	ND	ND	µg/L	--	0/12	0.43 - 5	N/A	3.3	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/L	--	0/12	0.42 - 5	N/A	0.75	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/L	--	0/12	0.28 - 5	N/A	81	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/L	--	0/12	0.26 - 5	N/A	0.46	C	N	ND
108-90-7	**Chlorobenzene**	**0.31 J**	**130**	**µg/L**	**VAS-11 (12/8/2008)**	**4/12**	**0.14 - 1**	**130**	**7.8**	**N**	**Y**	**ASV**
75-00-3	Chloroethane	0.69 J	6.1	µg/L	VAS-11 (12/8/2008)	3/12	0.41 - 3.3	6.1	2100	N	N	BSV
67-66-3	**Chloroform (Trichloromethane)**	**0.32 J**	**0.32 J**	**µg/L**	**VAS-38 (2/7/2018)**	**1/12**	**0.13 - 5**	**0.32 J**	**0.22**	**C**	**Y**	**ASV**
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/L	--	0/12	0.2 - 5	N/A	19	N	N	ND
156-59-2	cis-1,2-Dichloroethene	1.8	1.8	µg/L	MW-101A (5/13/2015)	1/12	0.16 - 5	1.8	3.6		N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/L	--	0/12	0.26 - 5	N/A	0.47	C	N	ND
110-82-7	Cyclohexane	0.14 J	0.92 J	µg/L	VAS-11 (12/8/2008)	2/12	0.24 - 1	0.92 J	1300	N	N	BSV
124-48-1	Dibromochloromethane	0.32 J	0.32 J	µg/L	VAS-38 (2/7/2018)	1/12	0.25 - 5	0.32 J	0.87	C	N	BSV
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/L	--	0/12	0.35 - 5	N/A	20	N	N	ND
100-41-4	**Ethylbenzene**	**0.39 J**	**4.5 J**	**µg/L**	**VAS-37 (9/18/2018)**	**2/12**	**0.11 - 5**	**4.5 J**	**1.5**	**C**	**Y**	**ASV**
98-82-8	Isopropyl benzene	1.7 J	1.7 J	µg/L	VAS-37 (9/18/2018)	1/12	0.09 - 5	1.7 J	45	N	N	BSV
79-20-9	Methyl acetate	ND	ND	µg/L	--	0/12	1.4 - 50	N/A	2000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/L	--	0/12	0.33 - 5	N/A	1300 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/L	--	0/12	0.07 - 25	N/A	14	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/L	--	0/12	0.53 - 10	N/A	11	N	N	ND
100-42-5	Styrene	ND	ND	µg/L	--	0/12	0.1 - 5	N/A	120	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/L	--	0/12	0.15 - 5	N/A	4.1	N	N	ND
108-88-3	Toluene	0.38 J	82 J	µg/L	VAS-37 (9/18/2018)	8/12	0.14 - 1	82 J	110	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/L	--	0/12	0.19 - 5	N/A	36	N	N	ND
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/L	--	0/12	0.31 - 5	N/A	0.47	C	N	ND

Table 2.40

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - OU1 Upper Aquifer (EU1 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
79-01-6	**Trichloroethene**	**2.4 J**	**2.4 J**	**µg/L**	**VAS-37 (9/18/2018)**	**1/12**	**0.1 - 5**	**2.4 J**	**0.28**	**N**	**Y**	**ASV**
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/L	--	0/12	0.45 - 5	N/A	520	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/L	--	0/12	0.41 - 5	N/A	1000	N	N	ND
75-01-4	**Vinyl chloride**	**0.27 J**	**1.7**	**µg/L**	**MW-101A (5/13/2015)**	**3/12**	**0.2 - 5**	**1.7**	**0.019**	**C**	**Y**	**ASV**
1330-20-7	Xylenes (total)	0.75 J	19 J	µg/L	VAS-37 (9/18/2018)	2/12	0.15 - 10	19 J	19	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/L	--	0/5	0.41 - 2.6	N/A	71	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/L	--	0/5	0.31 - 9.6	N/A	120	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/L	--	0/5	0.24 - 8.7	N/A	1.2	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/L	--	0/5	0.19 - 2	N/A	4.6	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/L	--	0/5	0.26 - 2.5	N/A	36	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/L	--	0/5	0.33 - 30	N/A	3.9	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/L	--	0/5	0.26 - 10	N/A	0.24	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/L	--	0/5	0.82 - 10	N/A	0.049	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/L	--	0/5	0.1 - 2.3	N/A	75	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/L	--	0/5	0.26 - 1.3	N/A	9.1	N	N	ND
91-57-6	2-Methylnaphthalene	ND	ND	µg/L	--	0/5	0.092 - 0.53	N/A	3.6	N	N	ND
95-48-7	2-Methylphenol	ND	ND	µg/L	--	0/5	0.17 - 1	N/A	93	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/L	--	0/5	0.21 - 2.5	N/A	19	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/L	--	0/5	0.29 - 2.7	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/L	--	0/5	0.18 - 1	N/A	93 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/L	--	0/4	0.38 - 5.5	N/A	0.1	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/L	--	0/5	0.29 - 2.7	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/L	--	0/5	2.4 - 14	N/A	0.15	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/L	--	0/5	0.22 - 2.4	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/L	--	0/5	0.21 - 2	N/A	140	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/L	--	0/5	0.21 - 2	N/A	0.37	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/L	--	0/5	0.31 - 2.6	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/L	--	0/5	0.22 - 4.4	N/A	3.8	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/L	--	0/5	0.3 - 10	N/A	--		N	ND
83-32-9	Acenaphthene	ND	ND	µg/L	--	0/5	0.045 - 0.83	N/A	53	N	N	ND
208-96-8	Acenaphthylene	ND	ND	µg/L	--	0/5	0.049 - 0.6	N/A	53	N	N	ND
98-86-2	Acetophenone	ND	ND	µg/L	--	0/5	0.35 - 1.8	N/A	190	N	N	ND
120-12-7	Anthracene	ND	ND	µg/L	--	0/5	0.09 - 0.65	N/A	180	N	N	ND
1912-24-9	Atrazine	ND	ND	µg/L	--	0/5	0.35 - 4.6	N/A	0.3	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/L	--	0/5	0.4 - 3.6	N/A	19	N	N	ND
56-55-3	Benzo(a)anthracene	ND	ND	µg/L	--	0/5	0.03 - 0.82	N/A	0.03	C	N	ND
50-32-8	Benzo(a)pyrene	ND	ND	µg/L	--	0/5	0.052 - 0.83	N/A	0.025	C	N	ND
205-99-2	Benzo(b)fluoranthene	ND	ND	µg/L	--	0/5	0.04 - 0.74	N/A	0.25	C	N	ND
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/L	--	0/5	0.047 - 0.86	N/A	12 (5)	N	N	ND

Table 2.40

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - OU1 Upper Aquifer (EU1 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
207-08-9	Benzo(k)fluoranthene	ND	ND	µg/L	--	0/5	0.046 - 0.67	N/A	2.5	C	N	ND
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/L	--	0/5	0.13 - 2.4	N/A	0.083	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/L	--	0/5	0.33 - 2.2	N/A	5.9	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/L	--	0/5	0.1 - 1.9	N/A	0.014	C	N	ND
117-81-7	**bis(2-Ethylhexyl)phthalate (DEHP)**	**160**	**160**	**µg/L**	**VAS-37 (9/18/2018)**	**1/5**	**1.7 - 2.2**	**160**	**5.6**	**C**	**Y**	**ASV**
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/L	--	0/5	0.27 - 3.2	N/A	16	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/L	--	0/4	0.2 - 5	N/A	990	N	N	ND
86-74-8	Carbazole	ND	ND	µg/L	--	0/5	0.29 - 2.4	N/A	--		N	ND
218-01-9	Chrysene	ND	ND	µg/L	--	0/5	0.051 - 0.89	N/A	25	C	N	ND
53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/L	--	0/5	0.046 - 0.73	N/A	0.025	C	N	ND
132-64-9	Dibenzofuran	ND	ND	µg/L	--	0/5	0.02 - 2.7	N/A	0.79	N	N	ND
84-66-2	Diethyl phthalate	0.68 J	0.68 J	µg/L	VAS-38 (2/7/2018)	1/5	1 - 18	0.68 J	1500	N	N	BSV
131-11-3	Dimethyl phthalate	ND	ND	µg/L	--	0/5	0.3 - 2.5	N/A	1500	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/L	--	0/5	1 - 8.7	N/A	90	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/L	--	0/5	0.23 - 3.9	N/A	20	N	N	ND
206-44-0	Fluoranthene	ND	ND	µg/L	--	0/5	0.046 - 0.77	N/A	80	N	N	ND
86-73-7	Fluorene	ND	ND	µg/L	--	0/5	0.041 - 0.81	N/A	29	N	N	ND
118-74-1	Hexachlorobenzene	ND	ND	µg/L	--	0/5	0.087 - 0.77	N/A	0.0098	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	--	0/5	0.28 - 2.6	N/A	0.14	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	--	0/5	0.24 - 10	N/A	0.041	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/L	--	0/5	0.19 - 1.9	N/A	0.33	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	ND	ND	µg/L	--	0/5	0.044 - 0.65	N/A	0.25	C	N	ND
78-59-1	Isophorone	ND	ND	µg/L	--	0/5	0.28 - 1.6	N/A	78	C	N	ND
91-20-3	**Naphthalene**	**1.2**	**4.9**	**µg/L**	**BH92-13 (7/9/2013)**	**3/7**	**0.064 - 0.2**	**4.9**	**0.17**	**C**	**Y**	**ASV**
98-95-3	Nitrobenzene	ND	ND	µg/L	--	0/5	0.041 - 2.5	N/A	0.14	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/L	--	0/5	0.24 - 1.2	N/A	0.011	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/L	--	0/5	0.32 - 2.1	N/A	12	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/L	--	0/4	0.28 - 15	N/A	0.041	C	N	ND
85-01-8	Phenanthrene	ND	ND	µg/L	--	0/5	0.063 - 0.8	N/A	12 (5)	N	N	ND
108-95-2	Phenol	ND	ND	µg/L	--	0/5	0.12 - 1	N/A	580	N	N	ND
129-00-0	Pyrene	ND	ND	µg/L	--	0/5	0.043 - 0.84	N/A	12	N	N	ND
	Metals											
7429-90-5	**Aluminum**	**320 J**	**15000 J**	**µg/L**	**VAS-38 (2/7/2018)**	**5/5**	**--**	**15000 J**	**2000**	**N**	**Y**	**ASV**
7440-36-0	**Antimony**	**1.1 J**	**13**	**µg/L**	**VAS-37 (9/18/2018)**	**3/5**	**0.57**	**13**	**0.78**	**N**	**Y**	**ASV**
7440-38-2	**Arsenic**	**2.6 J**	**66.2**	**µg/L**	**VAS-19 (12/15/2008)**	**7/7**	**--**	**66.2**	**0.052**	**C**	**Y**	**ASV**
7440-39-3	**Barium**	**280**	**1500**	**µg/L**	**VAS-37 (9/18/2018)**	**5/5**	**--**	**1500**	**380**	**N**	**Y**	**ASV**
7440-41-7	Beryllium	0.41 J	0.90 J	µg/L	VAS-38 (2/7/2018)	3/5	0.31	0.90 J	2.5	N	N	BSV
7440-43-9	**Cadmium**	**0.25 J**	**4**	**µg/L**	**VAS-37 (9/18/2018)**	**3/5**	**0.21**	**4**	**0.92**	**N**	**Y**	**ASV**
7440-70-2	Calcium	46000	220000 J	µg/L	VAS-38 (2/7/2018)	5/5	--	220000 J	--		N	NAT
7440-47-3	**Chromium**	**1.3 J**	**36**	**µg/L**	**VAS-38 (2/7/2018)**	**5/5**	**0.98**	**36**	**0.035**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**0.69 J**	**14 J**	**µg/L**	**VAS-38 (2/7/2018)**	**5/5**	**--**	**14 J**	**0.6**	**N**	**Y**	**ASV**
7440-50-8	**Copper**	**1.8 J**	**170**	**µg/L**	**VAS-37 (9/18/2018)**	**5/5**	**1.7**	**170**	**0.035**	**N**	**Y**	**ASV**

Table 2.40

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - OU1 Upper Aquifer (EU1 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
57-12-5	Cyanide (total)	ND	ND	µg/L	--	0/3	6	N/A	0.15	N	N	ND
7439-89-6	**Iron**	**1200**	**35000 J**	**µg/L**	**VAS-38 (2/7/2018)**	**5/5**	**--**	**35000 J**	**1400**	**N**	**Y**	**ASV**
7439-92-1	**Lead**	**0.62 J**	**340**	**µg/L**	**VAS-37 (9/18/2018)**	**7/7**	**--**	**340**	**15**	**C**	**Y**	**ASV**
7439-95-4	Magnesium	18000	100000	µg/L	VAS-37 (9/18/2018)	5/5	--	100000	--		N	NAT
7439-96-5	**Manganese**	**170**	**1300**	**µg/L**	**VAS-38 (2/7/2018)**	**5/5**	**--**	**1300**	**43**	**N**	**Y**	**ASV**
7439-97-6	Mercury	ND	ND	µg/L	--	0/5	0.13 - 0.18	N/A	0.063	N	N	ND
7440-02-0	**Nickel**	**2.6**	**46**	**µg/L**	**VAS-37 (9/18/2018)**	**5/5**	**--**	**46**	**39**	**N**	**Y**	**ASV**
7440-09-7	Potassium	6800	62000	µg/L	VAS-37 (9/18/2018)	5/5	--	62000	--		N	NAT
7782-49-2	Selenium	1.2 J	3.1 J	µg/L	VAS-38 (2/7/2018)	3/5	0.89	3.1 J	10	N	N	BSV
7440-22-4	Silver	0.060 J	0.51 J	µg/L	MW-209 (10/17/2018)	3/5	0.053	0.51 J	9.4	N	N	BSV
7440-23-5	Sodium	30000	90000	µg/L	VAS-37 (9/18/2018)	5/5	--	90000	--		N	NAT
7440-28-0	**Thallium**	**0.26 J**	**0.58 J**	**µg/L**	**VAS-38 (2/7/2018)**	**3/5**	**0.2**	**0.58 J**	**0.02**	**N**	**Y**	**ASV**
7440-62-2	**Vanadium**	**1.8 J**	**37 J**	**µg/L**	**VAS-38 (2/7/2018)**	**5/5**	**0.82**	**37 J**	**8.6**	**N**	**Y**	**ASV**
7440-66-6	**Zinc**	**290 J**	**1200**	**µg/L**	**VAS-37 (9/18/2018)**	**4/5**	**15**	**1200**	**600**	**N**	**Y**	**ASV**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/L	--	0/3	0.052 - 0.054	N/A	0.14	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/L	--	0/3	0.054 - 0.094	N/A	0.0047	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/L	--	0/3	0.07 - 0.073	N/A	0.0047	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/L	--	0/3	0.063 - 0.074	N/A	0.0078	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/L	--	0/3	0.048 - 0.052	N/A	0.0078	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	ND	ND	µg/L	--	0/3	0.031 - 0.039	N/A	0.0078	C	N	ND
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/L	--	0/3	0.042 - 0.045	N/A	0.0078	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/L	--	0/3	0.0051 - 0.28	N/A	0.0063	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/L	--	0/3	0.0041 - 0.23	N/A	0.046	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/L	--	0/3	0.0046 - 0.26	N/A	0.23	C	N	ND
309-00-2	Aldrin	ND	ND	µg/L	--	0/3	0.0023 - 0.13	N/A	0.00092	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/L	--	0/3	0.0019 - 0.11	N/A	0.0072	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/L	--	0/3	0.0031 - 0.17	N/A	0.02	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/L	--	0/3	0.0044 - 0.24	N/A	0.025	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/L	--	0/3	0.0041 - 0.23	N/A	0.025	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/L	--	0/3	0.0022 - 0.12	N/A	0.0018	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/L	--	0/3	0.0036 - 0.2	N/A	10	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/L	--	0/3	0.0022 - 0.12	N/A	10	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/L	--	0/3	0.0036 - 0.2	N/A	11	N	N	ND
72-20-8	Endrin	ND	ND	µg/L	--	0/3	0.0024 - 0.13	N/A	0.23	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/L	--	0/3	0.0044 - 0.24	N/A	0.23	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/L	--	0/3	0.0038 - 0.21	N/A	0.23	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/L	--	0/3	0.0024 - 0.13	N/A	0.042	C	N	ND

Table 2.40

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Groundwater - OU1 Upper Aquifer (EU1 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Groundwater

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
5103-74-2	gamma-Chlordane	ND	ND	µg/L	--	0/3	0.0048 - 0.27	N/A	0.02	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/L	--	0/3	0.0032 - 0.18	N/A	0.0014	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/L	--	0/3	0.0025 - 0.14	N/A	0.0014	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/L	--	0/3	0.0045 - 0.25	N/A	3.7	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/L	--	0/3	0.056 - 3.1	N/A	0.071	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/L	--	0/1	0.57	N/A	16	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/L	--	0/1	0.43	N/A	11	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/L	--	0/1	2.2	N/A	17	N	N	ND
	Petroleum Products											
--	Total Petroleum Hydrocarbons (C10-C20)	ND	ND	µg/L	--	0/0	--	N/A	--	N	N	ND
--	Total Petroleum Hydrocarbons (C20-C34)	ND	ND	µg/L	--	0/0	--	N/A	--	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.
(2) Based on data collected from sampling locations: BH92-13, BH93-13, MW-101A, MW-204, MW-209, VAS-11, VAS-19, VAS-37, VAS-38.
(3) Regional Screening Levels (RSL) Summary Table (TR=1E-6, HQ=0.1), Tap Water, November 2019.
(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) The RSL for chromium is based on chromium VI.

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
N - Tentatively identified compound.

Table 2.41

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/27	1 - 6.9	N/A	94400000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/27	1.8 - 12	N/A	21000	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/27	1.4 - 9.5	N/A	73600	C	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/27	0.86 - 5.8	N/A	736000	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/27	1.1 - 7.6	N/A	2360000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/27	0.71 - 4.8	N/A	145000	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/27	4.4 - 30	N/A	1160	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/27	0.95 - 6.5	N/A	2100	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/27	1.4 - 9.3	N/A	4250000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/27	0.95 - 6.5	N/A	46100	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/27	1.1 - 7.1	N/A	113000	C	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/27	1 - 6.8	N/A	4250000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/27	1.1 - 7.4	N/A	777000	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	5.2 J	73 J	µg/kg	SD-19: 0-0.5 ft BSS (9/24/2018)	21/27	4.4 - 13	73 J	28300000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/27	5 - 34	N/A	236000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/27	4.6 - 31	N/A	--	N	N	ND
67-64-1	Acetone	65	210	µg/kg	SD-19: 0-0.5 ft BSS (9/24/2018)	4/27	26 - 180	210	42500000	N	N	BSV
71-43-2	Benzene	3.9 J	6.4 J	µg/kg	SD-20: 0-0.5 ft BSS (9/21/2018)	3/27	0.86 - 5.9	6.4 J	76300	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/27	0.84 - 5.7	N/A	67700	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/27	3 - 20	N/A	531000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/27	1.2 - 8.3	N/A	66100	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/27	1.4 - 9.8	N/A	4720000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/27	4 - 27	N/A	59900	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/27	1.1 - 7.7	N/A	944000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/27	1.5 - 10	N/A	381000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/27	0.97 - 6.6	N/A	135000	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/27	1.3 - 8.7	N/A	--		N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/27	0.8 - 5.5	N/A	94400	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/27	1.8 - 12	N/A	42000	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/27	1.7 - 12	N/A	--		N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/27	3.4 - 23	N/A	49900	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/27	1.2 - 7.9	N/A	9440000	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/27	1.3 - 8.8	N/A	381000	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/27	1 - 7	N/A	4720000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/27	4.2 - 29	N/A	47200000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/27	1.5 - 10	N/A	--		N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/27	1 - 6.9	N/A	2330000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/27	15 - 100	N/A	283000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/27	1.4 - 9.7	N/A	9440000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/27	0.9 - 6.1	N/A	283000	N	N	ND
108-88-3	Toluene	1.5 J	5.8 J	µg/kg	SD-01: 0-0.5 ft BSS (9/25/2018)	3/27	0.95 - 6.5	5.8 J	3780000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/27	0.57 - 3.9	N/A	944000	N	N	ND

Table 2.41

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	4.7 J	4.7 J	µg/kg	SD-07: 0-0.5 ft BSS (9/25/2018)	1/27	1.3 - 8.7	4.7 J	42000	C	N	BSV
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/27	0.78 - 5.3	N/A	23600	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/27	1.3 - 9	N/A	14200000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/27	1.6 - 11	N/A	--		N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/27	1 - 7	N/A	69.6	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/27	2 - 13	N/A	9440000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/37	12 - 650	N/A	1890000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/37	86 - 4500	N/A	3810000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/37	79 - 4100	N/A	38100	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/37	55 - 2900	N/A	236000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/37	50 - 2600	N/A	763000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/36	180 - 9200	N/A	76300	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/37	77 - 4000	N/A	10500	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/37	69 - 3600	N/A	2190	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/37	17 - 910	N/A	2890000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/37	12 - 650	N/A	236000	N	N	ND
91-57-6	2-Methylnaphthalene	7.4 J	260 J	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	18/37	2.4 - 11	260 J	144000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/37	38 - 2000	N/A	1910000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/37	50 - 2600	N/A	381000	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/37	16 - 840	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/37	36 - 1900	N/A	1910000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/37	53 - 2800	N/A	7280	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/37	61 - 3200	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/37	99 - 5200	N/A	3050	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/37	17 - 910	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/37	56 - 2900	N/A	3810000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/37	37 - 1900	N/A	16400	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/37	17 - 910	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/37	74 - 3900	N/A	153000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/37	120 - 6100	N/A	--		N	ND
83-32-9	Acenaphthene	4.8 J	2900	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	22/37	3.5 - 16	2900	2160000	N	N	BSV
208-96-8	Acenaphthylene	11 J	120	µg/kg	SD-05: 0.5-1.5 ft BSS (9/21/2018)	14/37	5 - 260	120	2160000 (5)	N	N	BSV
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/37	14 - 710	N/A	4720000	N	N	ND
120-12-7	Anthracene	5.7 J	7800	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	35/37	5.5 - 8.6	7800	10800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/37	45 - 2300	N/A	14200	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/kg	--	0/37	28 - 1500	N/A	1050000	N	N	ND
56-55-3	**Benzo(a)anthracene**	**31 J**	**26000**	**µg/kg**	**SD-17: 0-0.5 ft BSS (9/21/2018)**	**37/37**	**--**	**26000**	**6930**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**38**	**22000**	**µg/kg**	**SD-17: 0-0.5 ft BSS (9/21/2018)**	**37/37**	**--**	**22000**	**693**	**C**	**Y**	**ASV**
205-99-2	**Benzo(b)fluoranthene**	**50**	**33000**	**µg/kg**	**SD-17: 0-0.5 ft BSS (9/21/2018)**	**37/37**	**--**	**33000**	**6930**	**C**	**Y**	**ASV**

Table 2.41

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	20 J	11000	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	37/37	--	11000	1080000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	14 J	9300	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	37/37	--	9300	69300	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/kg	--	0/37	21 - 1100	N/A	524000	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/37	15 - 780	N/A	114000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/37	15 - 780	N/A	3810	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	120	560	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	9/37	63 - 3300	560	234000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/37	27 - 1400	N/A	1720000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/37	93 - 4900	N/A	19100000	N	N	ND
86-74-8	**Carbazole**	**35 J**	**5400**	**µg/kg**	**SD-17: 0-0.5 ft BSS (9/21/2018)**	**12/37**	**24 - 110**	**5400**	**--**		**Y**	**AD**
218-01-9	Chrysene	38	29000	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	37/37	--	29000	693000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**20 J**	**3700**	**µg/kg**	**SD-17: 0-0.5 ft BSS (9/21/2018)**	**21/37**	**8.6 - 40**	**3700**	**693**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	22 J	1600 J	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	10/37	16 - 74	1600 J	44100	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/37	38 - 2000	N/A	30500000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/37	17 - 910	N/A	30500000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	2900	2900	µg/kg	SD-17D: 0.5-0.92 ft BSS (10/4/2019)	1/37	27 - 1400	2900	3810000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/37	35 - 1800	N/A	381000	N	N	ND
206-44-0	Fluoranthene	67	59000	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	37/37	--	59000	1440000	N	N	BSV
86-73-7	Fluorene	5.1 J	3000	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	26/37	3.8 - 16	3000	1440000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/37	3.5 - 180	N/A	2620	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/37	15 - 780	N/A	47200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/34	77 - 4000	N/A	283000	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/37	11 - 580	N/A	33000	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**20 J**	**11000**	**µg/kg**	**SD-17: 0-0.5 ft BSS (9/21/2018)**	**36/37**	**15**	**11000**	**6930**	**C**	**Y**	**ASV**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/37	15 - 780	N/A	3450000	C	N	ND
91-20-3	Naphthalene	7.1 J	300 J	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	18/37	3 - 14	300 J	721000	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/37	16 - 840	N/A	94400	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/37	14 - 710	N/A	468	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/37	15 - 780	N/A	668000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/37	72 - 3800	N/A	6160	C	N	ND
85-01-8	Phenanthrene	25	37000	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	37/37	--	37000	1080000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/37	9.9 - 520	N/A	11400000	N	N	ND
129-00-0	Pyrene	57	41000	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	37/37	--	41000	1080000	N	N	BSV
	Metals											
7429-90-5	Aluminum	1500	12000 J	mg/kg	SD-10: 0-0.5 ft BSS (9/25/2018)	27/27	--	12000 J	47200	N	N	BSV
7440-36-0	Antimony	0.12 J	0.76	mg/kg	SD-05: 0.5-1.5 ft BSS (9/21/2018)	24/27	0.16 - 0.66	0.76	18.9	N	N	BSV
7440-38-2	**Arsenic**	**3**	**24**	**mg/kg**	**SD-10: 0-0.5 ft BSS (9/25/2018)**	**27/27**	**--**	**24**	**4.09**	**C**	**Y**	**ASV**
7440-39-3	Barium	19	290	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	27/27	--	290	9440	N	N	BSV
7440-41-7	Beryllium	0.12 J	0.89	mg/kg	SD-10: 0-0.5 ft BSS (9/25/2018)	22/27	0.13 - 0.47	0.89	94.4	N	N	BSV
7440-43-9	Cadmium	0.059 J	0.86	mg/kg	SD-06: 0.5-1.5 ft BSS (9/25/2018)	27/27	--	0.86	43.1	N	N	BSV
7440-70-2	Calcium	49000	210000	mg/kg	SD-15: 0-0.5 ft BSS (9/26/2018)	27/27	--	210000	--		N	NAT
7440-47-3	**Chromium**	**3.7**	**20**	**mg/kg**	**SD-06: 0.5-1.5 ft BSS (9/25/2018)**	**27/27**	**--**	**20**	**1.85 (6)**	**C**	**Y**	**ASV**
7440-48-4	Cobalt	2.4	11	mg/kg	SD-11: 0.5-1.5 ft BSS (9/25/2018)	27/27	--	11	14.2	N	N	BSV

Table 2.41

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
7440-50-8	Copper	2.9	39	mg/kg	SD-06: 0.5-1.5 ft BSS (9/25/2018)	27/27	--	39	1890	N	N	BSV
57-12-5	Cyanide (total)	0.58 J	2.6	mg/kg	SD-15: 0-0.5 ft BSS (9/26/2018)	6/27	0.24 - 1.1	2.6	28.3	N	N	BSV
7439-89-6	Iron	5600	25000	mg/kg	SD-10: 0-0.5 ft BSS (9/25/2018)	27/27	--	25000	33000	N	N	BSV
7439-92-1	Lead	3.2	140	mg/kg	SD-01: 0-0.5 ft BSS (9/25/2018)	27/27	--	140	400	C	N	BSV
7439-95-4	Magnesium	14000	63000	mg/kg	SD-16: 0-0.5 ft BSS (9/26/2018)	27/27	--	63000	--		N	NAT
7439-96-5	Manganese	240	1000	mg/kg	SD-11: 0.5-1.5 ft BSS (9/25/2018)	27/27	--	1000	1130	N	N	BSV
7439-97-6	Mercury	0.049 J	0.17 J	mg/kg	SD-04: 0.5-1.5 ft BSS (9/21/2018)	20/27	0.021 - 0.1	0.17 J	1.1	N	N	BSV
22967-92-6	Methyl mercury	0.14 J	0.69	µg/kg	SD-14: 0-0.5 ft BSS (9/26/2018)	15/27	0.087 - 0.42	0.69	4.72	N	N	BSV
7440-02-0	Nickel	4.1	26	mg/kg	SD-11: 0.5-1.5 ft BSS (9/25/2018)	27/27	--	26	944	N	N	BSV
7440-09-7	Potassium	280	2000 J	mg/kg	SD-10: 0-0.5 ft BSS (9/25/2018)	27/27	--	2000 J	--		N	NAT
7782-49-2	Selenium	0.14 J	1.8 J	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	26/27	0.12 - 0.16	1.8 J	236	N	N	BSV
7440-22-4	Silver	0.049 J	0.35 J	mg/kg	SD-07: 0-0.5 ft BSS (9/25/2018)	22/27	0.022 - 0.12	0.35 J	236	N	N	BSV
7440-23-5	Sodium	120 J	380 J	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	27/27	--	380 J	--		N	NAT
7440-28-0	**Thallium**	**0.073 J**	**0.55 J**	**mg/kg**	**SD-10: 0-0.5 ft BSS (9/25/2018)**	**27/27**	**--**	**0.55 J**	**0.472**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	6.1	29	mg/kg	SD-10: 0-0.5 ft BSS (9/25/2018)	27/27	--	29	238	N	N	BSV
7440-66-6	Zinc	13	390	mg/kg	SD-06: 0.5-1.5 ft BSS (9/25/2018)	27/27	--	390	14200	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/27	26 - 120	N/A	2480	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/27	29 - 130	N/A	1500	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/27	28 - 130	N/A	1500	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	43 J	130 J	µg/kg	SD-13: 0-0.5 ft BSS (9/25/2018)	10/27	23 - 100	130 J	1500	C	N	BSV
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/27	29 - 130	N/A	1500	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	69 J	420	µg/kg	SD-17: 0-0.5 ft BSS (9/21/2018)	4/27	28 - 130	420	709	C	N	BSV
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/27	26 - 120	N/A	1500	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/27	2 - 540	N/A	1140	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/27	1.8 - 49	N/A	12300	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/kg	--	0/27	1.5 - 410	N/A	11400	C	N	ND
309-00-2	Aldrin	ND	ND	µg/kg	--	0/27	0.92 - 25	N/A	247	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/27	1.2 - 330	N/A	520	C	N	ND
5103-71-9	alpha-Chlordane	5.5 J	5.5 J	µg/kg	SD-05: 0.5-1.5 ft BSS (9/21/2018)	1/27	1.8 - 48	5.5 J	10800	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/27	2.1 - 56	N/A	1820	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/26	40 - 970	N/A	1820	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/27	1.3 - 35	N/A	205	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/27	1.4 - 39	N/A	283000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/27	1.8 - 48	N/A	283000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/27	1.7 - 470	N/A	229000	N	N	ND
72-20-8	Endrin	ND	ND	µg/kg	--	0/27	2.3 - 61	N/A	11400	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/27	1.6 - 760	N/A	11400	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/27	1.1 - 180	N/A	11400	N	N	ND

Table 2.41

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/27	2.4 - 650	N/A	3430	C	N	ND
5103-74-2	gamma-Chlordane	2.3 J	12 J	µg/kg	SD-14: 0-0.5 ft BSS (9/26/2018)	5/27	1.5 - 40	12 J	10800	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/27	1.9 - 51	N/A	932	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/27	1.7 - 46	N/A	461	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/27	7.9 - 1300	N/A	191000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/27	30 - 800	N/A	2980	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/27	16 - 74	N/A	381000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/27	17 - 80	N/A	305000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/27	59 - 280	N/A	422000	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SD-01, SD-02, SD-03, SD-04, SD-05, SD-05A, SD-05B, SD-06, SD-07, SD-08, SD-10, SD-11, SD-12, SD-13, SD-14, SD-15, SD-16, SD-17, SD-17A, SD-17B, SD-17C, SD-17D, SD-17E, SD-18, SD-19, SD-20.

(3) Regional Screening Level (RSL) Calculator (TR = 1E-06, HI = 0.1) for Sediment, Recreational User, accessed on January 21, 2020.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) The RSL for chromium is based on chromium VI.

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.42

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment (Shallow)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment (Shallow)
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/4	1 - 6.9	N/A	94400000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/4	1.8 - 12	N/A	21000	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/4	1.4 - 9.5	N/A	73600	C	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/4	0.87 - 5.8	N/A	736000	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/4	1.1 - 7.6	N/A	2360000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/4	0.72 - 4.8	N/A	145000	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/4	4.5 - 30	N/A	1160	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/4	0.97 - 6.5	N/A	2100	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/4	1.4 - 9.3	N/A	4250000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/4	0.97 - 6.5	N/A	46100	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/4	1.1 - 7.1	N/A	113000	C	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/4	1 - 6.8	N/A	4250000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/4	1.1 - 7.4	N/A	777000	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	12 J	65 J	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	3/4	6.4	65 J	28300000	N	N	BSV
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/4	5.1 - 34	N/A	236000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/4	4.7 - 31	N/A	--	N	N	ND
67-64-1	Acetone	ND	ND	µg/kg	--	0/4	26 - 180	N/A	42500000	N	N	ND
71-43-2	Benzene	ND	ND	µg/kg	--	0/4	0.88 - 5.9	N/A	76300	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/4	0.86 - 5.7	N/A	67700	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/4	3 - 20	N/A	531000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/4	1.2 - 8.3	N/A	66100	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/4	1.5 - 9.8	N/A	4720000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/4	4.1 - 27	N/A	59900	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/4	1.2 - 7.7	N/A	944000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/4	1.5 - 10	N/A	381000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/4	0.99 - 6.6	N/A	135000	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/4	1.3 - 8.7	N/A	--		N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/4	0.82 - 5.5	N/A	94400	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/4	1.8 - 12	N/A	42000	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/4	1.7 - 12	N/A	--		N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/4	3.5 - 23	N/A	49900	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/4	1.2 - 7.9	N/A	9440000	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/4	1.3 - 8.8	N/A	381000	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/4	1 - 7	N/A	4720000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/4	4.3 - 29	N/A	47200000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/4	1.5 - 10	N/A	--		N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/4	1 - 6.9	N/A	2330000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/4	15 - 100	N/A	283000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/4	1.5 - 9.7	N/A	9440000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/4	0.92 - 6.1	N/A	283000	N	N	ND
108-88-3	Toluene	1.5 J	1.5 J	µg/kg	SD-16: 0-0.5 ft BSS (9/26/2018)	1/4	1.4 - 6.5	1.5 J	3780000	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/4	0.59 - 3.9	N/A	944000	N	N	ND

Table 2.42

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment (Shallow)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment (Shallow)
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	4.7 J	4.7 J	µg/kg	SD-07: 0-0.5 ft BSS (9/25/2018)	1/4	1.3 - 8.7	4.7 J	42000	C	N	BSV
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/4	0.8 - 5.3	N/A	23600	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/4	1.4 - 9	N/A	14200000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/4	1.6 - 11	N/A	--		N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/4	1.1 - 7	N/A	69.6	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/4	2 - 13	N/A	9440000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/4	12 - 57	N/A	1890000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/4	86 - 400	N/A	3810000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/4	79 - 370	N/A	38100	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/4	55 - 250	N/A	236000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/4	50 - 230	N/A	763000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/4	180 - 810	N/A	76300	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/4	77 - 360	N/A	10500	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/4	69 - 320	N/A	2190	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/4	17 - 80	N/A	2890000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/4	12 - 57	N/A	236000	N	N	ND
91-57-6	2-Methylnaphthalene	ND	ND	µg/kg	--	0/4	2.4 - 11	N/A	144000	N	N	ND
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/4	38 - 180	N/A	1910000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/4	50 - 230	N/A	381000	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/4	16 - 74	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/4	36 - 170	N/A	1910000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/4	53 - 250	N/A	7280	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/4	61 - 280	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/4	99 - 460	N/A	3050	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/4	17 - 80	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/4	56 - 260	N/A	3810000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/4	37 - 170	N/A	16400	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/4	17 - 80	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/4	74 - 340	N/A	153000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/4	120 - 540	N/A	--		N	ND
83-32-9	Acenaphthene	ND	ND	µg/kg	--	0/4	3.5 - 16	N/A	2160000	N	N	ND
208-96-8	Acenaphthylene	ND	ND	µg/kg	--	0/4	5 - 23	N/A	2160000 (5)	N	N	ND
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/4	14 - 63	N/A	4720000	N	N	ND
120-12-7	Anthracene	7.0 J	28 J	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	28 J	10800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/4	45 - 210	N/A	14200	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/kg	--	0/4	28 - 130	N/A	1050000	N	N	ND
56-55-3	Benzo(a)anthracene	44	180	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	180	6930	C	N	BSV
50-32-8	Benzo(a)pyrene	49	230	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	230	693	C	N	BSV
205-99-2	Benzo(b)fluoranthene	67	290	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	290	6930	C	N	BSV

Table 2.42

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment (Shallow)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment (Shallow)
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	Benzo(g,h,i)perylene	30	140	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	140	1080000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	27	100	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	100	69300	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/kg	--	0/4	21 - 97	N/A	524000	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/4	15 - 69	N/A	114000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/4	15 - 69	N/A	3810	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	560	560	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	1/4	63 - 150	560	234000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	ND	ND	µg/kg	--	0/4	27 - 130	N/A	1720000	C	N	ND
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/4	93 - 430	N/A	19100000	N	N	ND
86-74-8	Carbazole	ND	ND	µg/kg	--	0/4	24 - 110	N/A	--		N	ND
218-01-9	Chrysene	54	220	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	220	693000	C	N	BSV
53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/kg	--	0/4	8.6 - 40	N/A	693	C	N	ND
132-64-9	Dibenzofuran	ND	ND	µg/kg	--	0/4	16 - 74	N/A	44100	N	N	ND
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/4	38 - 180	N/A	30500000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/4	17 - 80	N/A	30500000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/kg	--	0/4	27 - 130	N/A	3810000	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/4	35 - 160	N/A	381000	N	N	ND
206-44-0	Fluoranthene	100	380	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	380	1440000	N	N	BSV
86-73-7	Fluorene	5.1 J	5.1 J	µg/kg	SD-16: 0-0.5 ft BSS (9/26/2018)	1/4	5.2 - 16	5.1 J	1440000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/4	3.5 - 16	N/A	2620	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/4	15 - 69	N/A	47200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/4	77 - 360	N/A	283000	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/4	11 - 52	N/A	33000	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	29	140	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	140	6930	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/4	15 - 69	N/A	3450000	C	N	ND
91-20-3	Naphthalene	ND	ND	µg/kg	--	0/4	3 - 14	N/A	721000	C	N	ND
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/4	16 - 74	N/A	94400	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/4	14 - 63	N/A	468	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/4	15 - 69	N/A	668000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/4	72 - 330	N/A	6160	C	N	ND
85-01-8	Phenanthrene	38	120	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	120	1080000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/4	9.9 - 46	N/A	11400000	N	N	ND
129-00-0	Pyrene	76	330	µg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	330	1080000	N	N	BSV
	Metals											
7429-90-5	Aluminum	1500	6800	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	6800	47200	N	N	BSV
7440-36-0	Antimony	0.12 J	0.41 J	mg/kg	SD-12: 0-0.5 ft BSS (9/26/2018)	2/4	0.24 - 0.66	0.41 J	18.9	N	N	BSV
7440-38-2	**Arsenic**	**6.4**	**11**	**mg/kg**	**SD-03: 0-0.5 ft BSS (9/21/2018)**	**4/4**	**--**	**11**	**4.09**	**C**	**Y**	**ASV**
7440-39-3	Barium	19	290	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	290	9440	N	N	BSV
7440-41-7	Beryllium	0.22 J	0.41 J	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	2/4	0.13 - 0.15	0.41 J	94.4	N	N	BSV
7440-43-9	Cadmium	0.059 J	0.36 J	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	0.36 J	43.1	N	N	BSV
7440-70-2	Calcium	130000	200000	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	200000	--		N	NAT
7440-47-3	**Chromium**	**3.7**	**13**	**mg/kg**	**SD-03: 0-0.5 ft BSS (9/21/2018)**	**4/4**	**--**	**13**	**1.85 (6)**	**C**	**Y**	**ASV**
7440-48-4	Cobalt	2.4	5	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	5	14.2	N	N	BSV

Table 2.42

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment (Shallow)
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
7440-50-8	Copper	2.9	23	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	23	1890	N	N	BSV
57-12-5	Cyanide (total)	ND	ND	mg/kg	--	0/4	0.27 - 1.1	N/A	28.3	N	N	ND
7439-89-6	Iron	5800	14000	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	14000	33000	N	N	BSV
7439-92-1	Lead	3.2	25	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	25	400	C	N	BSV
7439-95-4	Magnesium	19000	63000	mg/kg	SD-16: 0-0.5 ft BSS (9/26/2018)	4/4	--	63000	--		N	NAT
7439-96-5	Manganese	320	520	mg/kg	SD-12: 0-0.5 ft BSS (9/26/2018)	4/4	--	520	1130	N	N	BSV
7439-97-6	Mercury	0.061 J	0.061 J	mg/kg	SD-12: 0-0.5 ft BSS (9/26/2018)	1/4	0.021 - 0.1	0.061 J	1.1	N	N	BSV
22967-92-6	Methyl mercury	ND	ND	µg/kg	--	0/4	0.087 - 0.42	N/A	4.72	N	N	ND
7440-02-0	Nickel	4.1	15	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	15	944	N	N	BSV
7440-09-7	Potassium	320	1200	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	1200	--		N	NAT
7782-49-2	Selenium	0.31 J	1.8 J	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	3/4	0.12	1.8 J	236	N	N	BSV
7440-22-4	Silver	0.35 J	0.35 J	mg/kg	SD-07: 0-0.5 ft BSS (9/25/2018)	1/4	0.022 - 0.12	0.35 J	236	N	N	BSV
7440-23-5	Sodium	140 J	380 J	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	380 J	--		N	NAT
7440-28-0	Thallium	0.079 J	0.32 J	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	0.32 J	0.472	N	N	BSV
7440-62-2	Vanadium	6.1	17	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	17	238	N	N	BSV
7440-66-6	Zinc	13	86	mg/kg	SD-03: 0-0.5 ft BSS (9/21/2018)	4/4	--	86	14200	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/4	26 - 120	N/A	2480	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/4	29 - 130	N/A	1500	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/4	28 - 130	N/A	1500	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	43 J	43 J	µg/kg	SD-07: 0-0.5 ft BSS (9/25/2018)	1/4	23 - 100	43 J	1500	C	N	BSV
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/4	29 - 130	N/A	1500	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	ND	ND	µg/kg	--	0/4	28 - 130	N/A	709	C	N	ND
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/4	26 - 120	N/A	1500	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/4	2.8 - 420	N/A	1140	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/4	1.8 - 8.8	N/A	12300	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/kg	--	0/4	2.1 - 320	N/A	11400	C	N	ND
309-00-2	Aldrin	ND	ND	µg/kg	--	0/4	0.92 - 4.5	N/A	247	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/4	1.7 - 260	N/A	520	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/kg	--	0/4	1.8 - 8.7	N/A	10800	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/4	2.1 - 10	N/A	1820	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/4	40 - 970	N/A	1820	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/4	1.3 - 6.4	N/A	205	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/4	1.4 - 7	N/A	283000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/4	1.8 - 8.6	N/A	283000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/4	7.4 - 360	N/A	229000	N	N	ND
72-20-8	Endrin	ND	ND	µg/kg	--	0/4	2.3 - 11	N/A	11400	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/4	1.6 - 760	N/A	11400	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/4	1.1 - 5.2	N/A	11400	N	N	ND

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Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment (Shallow)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment (Shallow)
Exposure Medium: Sediment

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/4	3.3 - 510	N/A	3430	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/kg	--	0/4	1.5 - 7.2	N/A	10800	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/4	1.9 - 9.2	N/A	932	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/4	1.7 - 8.4	N/A	461	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/4	7.9 - 38	N/A	191000	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/4	30 - 150	N/A	2980	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/4	16 - 74	N/A	381000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/4	17 - 80	N/A	305000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/4	59 - 280	N/A	422000	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.
(2) Based on data collected from sampling locations that are less than 10 feet below surface water: SD-03, SD-07, SD-12, SD-16.
(3) Regional Screening Level (RSL) Calculator (TR = 1E-06, HI = 0.1) for Sediment, Recreational User, accessed on January 21, 2020.
(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) The RSL for chromium is based on chromium VI.

Defintions:
N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.

Table 2.43

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/27	1 - 6.9	N/A	--	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/27	1.8 - 12	N/A	--	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/27	1.4 - 9.5	N/A	--	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/27	0.86 - 5.8	N/A	--	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/27	1.1 - 7.6	N/A	--	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/27	0.71 - 4.8	N/A	--	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/27	4.4 - 30	N/A	--	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/27	0.95 - 6.5	N/A	--	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/27	1.4 - 9.3	N/A	--	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/27	0.95 - 6.5	N/A	--	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/27	1.1 - 7.1	N/A	--	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/27	1 - 6.8	N/A	--	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/27	1.1 - 7.4	N/A	--	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	5.2 J	73 J	µg/kg	SD-19: 0-0.5 ft BGS (9/24/2018)	21/27	4.4 - 13	73	--	N	N	NOTBIO
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/27	5 - 34	N/A	--	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/27	4.6 - 31	N/A	--	N	N	ND
67-64-1	Acetone	65	210	µg/kg	SD-19: 0-0.5 ft BGS (9/24/2018)	4/27	26 - 180	210	--	N	N	NOTBIO
71-43-2	Benzene	3.9 J	6.4 J	µg/kg	SD-20: 0-0.5 ft BGS (9/21/2018)	3/27	0.86 - 5.9	6.4	--	C	N	NOTBIO
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/27	0.84 - 5.7	N/A	--	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/27	3 - 20	N/A	--	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/27	1.2 - 8.3	N/A	--	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/27	1.4 - 9.8	N/A	--	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/27	4 - 27	N/A	--	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/27	1.1 - 7.7	N/A	--	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/27	1.5 - 10	N/A	--	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/27	0.97 - 6.6	N/A	--	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/27	1.3 - 8.7	N/A	--	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/27	0.8 - 5.5	N/A	--	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/27	1.8 - 12	N/A	--	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/27	1.7 - 12	N/A	--	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/27	3.4 - 23	N/A	--	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/27	1.2 - 7.9	N/A	--	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/27	1.3 - 8.8	N/A	--	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/27	1 - 7	N/A	--	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/27	4.2 - 29	N/A	--	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/27	1.5 - 10	N/A	--	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/27	1 - 6.9	N/A	--	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/27	15 - 100	N/A	--	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/27	1.4 - 9.7	N/A	--	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/27	0.9 - 6.1	N/A	--	N	N	ND
108-88-3	Toluene	1.5 J	5.8 J	µg/kg	SD-01: 0-0.5 ft BGS (9/25/2018)	3/27	0.95 - 6.5	5.8	--	N	N	NOTBIO
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/27	0.57 - 3.9	N/A	--	N	N	ND

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South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
10061-02-6	trans-1,3-Dichloropropene	4.7 J	4.7 J	µg/kg	SD-07: 0-0.5 ft BGS (9/25/2018)	1/27	1.3 - 8.7	4.7	--	C	N	NOTBIO
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/27	0.78 - 5.3	N/A	--	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/27	1.3 - 9	N/A	--	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/27	1.6 - 11	N/A	--	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/27	1 - 7	N/A	--	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/27	2 - 13	N/A	--	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/37	12 - 650	N/A	--	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/37	86 - 4500	N/A	--	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/37	79 - 4100	N/A	--	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/37	55 - 2900	N/A	--	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/37	50 - 2600	N/A	--	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/36	180 - 9200	N/A	--	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/37	77 - 4000	N/A	--	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/37	69 - 3600	N/A	--	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/37	17 - 910	N/A	--	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/37	12 - 650	N/A	--	N	N	ND
91-57-6	2-Methylnaphthalene	7.4 J	260 J	µg/kg	SD-17: 0-0.5 ft BGS (9/21/2018)	18/37	2.4 - 11	260 J	--	N	N	NOTBIO
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/37	38 - 2000	N/A	--	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/37	50 - 2600	N/A	--	n	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/37	16 - 840	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/37	36 - 1900	N/A	--	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/37	53 - 2800	N/A	--	c	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/37	61 - 3200	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/37	99 - 5200	N/A	--	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/37	17 - 910	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/37	56 - 2900	N/A	--	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/37	37 - 1900	N/A	--	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/37	17 - 910	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/37	74 - 3900	N/A	--	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/37	120 - 6100	N/A	--		N	ND
83-32-9	**Acenaphthene**	**4.8 J**	**2900**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**22/37**	**3.5 - 16**	**2900**	**--**	**N**	**Y**	**BIO**
208-96-8	**Acenaphthylene**	**11 J**	**120**	**µg/kg**	**SD-05: 0.5-1.5 ft BGS (9/21/2018)**	**14/37**	**5 - 260**	**120**	**--**	**N**	**Y**	**BIO**
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/37	14 - 710	N/A	--	N	N	ND
120-12-7	**Anthracene**	**5.7 J**	**7800**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**35/37**	**5.5 - 8.6**	**7800**	**--**	**N**	**Y**	**BIO**
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/37	45 - 2300	N/A	--	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/kg	--	0/37	28 - 1500	N/A	--	N	N	ND
56-55-3	**Benzo(a)anthracene**	**31 J**	**26000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**37/37**	**--**	**26000**	**--**	**C**	**Y**	**BIO**
50-32-8	**Benzo(a)pyrene**	**38**	**22000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**37/37**	**--**	**22000**	**--**	**C**	**Y**	**BIO**
205-99-2	**Benzo(b)fluoranthene**	**50**	**33000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**37/37**	**--**	**33000**	**--**	**C**	**Y**	**BIO**

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Medium: Quarry Pond Sediment
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
191-24-2	**Benzo(g,h,i)perylene**	**20 J**	**11000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**37/37**	**--**	**11000**	**--**	**N**	**Y**	**BIO**
207-08-9	**Benzo(k)fluoranthene**	**14 J**	**9300**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**37/37**	**--**	**9300**	**--**	**C**	**Y**	**BIO**
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/kg	--	0/37	21 - 1100	N/A	--	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/37	15 - 780	N/A	--	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/37	15 - 780	N/A	--	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	120	560	µg/kg	SD-03: 0-0.5 ft BGS (9/21/2018)	9/37	63 - 3300	560	--	C	N	NOTBIO
85-68-7	Butyl benzylphthalate (BBP)	72	72	µg/kg	SD-13: 0-0.5 ft BGS (9/25/2018)	1/37	27 - 1400	72	--	C	N	NOTBIO
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/37	93 - 4900	N/A	--	N	N	ND
86-74-8	Carbazole	35 J	5400	µg/kg	SD-17: 0-0.5 ft BGS (9/21/2018)	12/37	24 - 110	5400	--		N	NOTBIO
218-01-9	**Chrysene**	**38**	**29000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**37/37**	**--**	**29000**	**--**	**C**	**Y**	**BIO**
53-70-3	**Dibenz(a,h)anthracene**	**20 J**	**3700**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**21/37**	**8.6 - 40**	**3700**	**--**	**C**	**Y**	**BIO**
132-64-9	Dibenzofuran	22 J	1600 J	µg/kg	SD-17: 0-0.5 ft BGS (9/21/2018)	10/37	16 - 74	1600 J	--	N	N	NOTBIO
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/37	38 - 2000	N/A	--	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/37	17 - 910	N/A	--	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	2900	2900	µg/kg	SD-17D: 0.5-0.92 ft BSS (10/4/2019)	1/37	27 - 1400	2900	--	N	N	NOTBIO
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/37	35 - 1800	N/A	--	N	N	ND
206-44-0	**Fluoranthene**	**67**	**59000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**37/37**	**--**	**59000**	**--**	**N**	**Y**	**BIO**
86-73-7	**Fluorene**	**5.1 J**	**3000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**26/37**	**3.8 - 16**	**3000**	**--**	**N**	**Y**	**BIO**
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/37	3.5 - 180	N/A	--	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/37	15 - 780	N/A	--	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/34	77 - 4000	N/A	--	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/37	11 - 580	N/A	--	C	N	ND
193-39-5	**Indeno(1,2,3-cd)pyrene**	**20 J**	**11000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**36/37**	**15**	**11000**	**--**	**C**	**Y**	**BIO**
78-59-1	Isophorone	ND	ND	µg/kg	--	0/37	15 - 780	N/A	--	C	N	ND
91-20-3	Naphthalene	7.1 J	300 J	µg/kg	SD-17: 0-0.5 ft BGS (9/21/2018)	18/37	3 - 14	300 J	--	C	N	NOTBIO
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/37	16 - 840	N/A	--	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/37	14 - 710	N/A	--	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/37	15 - 780	N/A	--	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/37	72 - 3800	N/A	--	C	N	ND
85-01-8	**Phenanthrene**	**25**	**37000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**37/37**	**--**	**37000**	**--**	**N**	**Y**	**BIO**
108-95-2	Phenol	ND	ND	µg/kg	--	0/37	9.9 - 520	N/A	--	N	N	ND
129-00-0	**Pyrene**	**57**	**41000**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**37/37**	**--**	**41000**	**--**	**N**	**Y**	**BIO**
	Metals											
7429-90-5	Aluminum	1500	12000 J	mg/kg	SD-10: 0-0.5 ft BGS (9/25/2018)	27/27	--	12000	--	N	N	NOTBIO
7440-36-0	Antimony	0.12 J	0.76	mg/kg	SD-05: 0.5-1.5 ft BGS (9/21/2018)	24/27	0.16 - 0.66	0.76	--	N	N	NOTBIO
7440-38-2	**Arsenic**	**3**	**24**	**mg/kg**	**SD-10: 0-0.5 ft BGS (9/25/2018)**	**27/27**	**--**	**24**	**--**	**C**	**Y**	**BIO**
7440-39-3	Barium	19	290	mg/kg	SD-03: 0-0.5 ft BGS (9/21/2018)	27/27	--	290	--	N	N	NOTBIO
7440-41-7	Beryllium	0.12 J	0.89	mg/kg	SD-10: 0-0.5 ft BGS (9/25/2018)	22/27	0.13 - 0.47	0.89	--	N	N	NOTBIO
7440-43-9	**Cadmium**	**0.059 J**	**0.86**	**mg/kg**	**SD-06: 0.5-1.5 ft BGS (9/25/2018)**	**27/27**	**--**	**0.86**	**--**	**N**	**Y**	**BIO**
7440-70-2	Calcium	49000	210000	mg/kg	SD-15: 0-0.5 ft BGS (9/26/2018)	27/27	--	210000	--		N	NOTBIO, NAT
7440-47-3	**Chromium**	**3.7**	**20**	**mg/kg**	**SD-06: 0.5-1.5 ft BGS (9/25/2018)**	**27/27**	**--**	**20**	**--**	**C**	**Y**	**BIO**
7440-48-4	Cobalt	2.4	11	mg/kg	SD-11: 0.5-1.5 ft BGS (9/25/2018)	27/27	--	11	--	N	N	NOTBIO

Table 2.43

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
7440-50-8	**Copper**	**2.9**	**39**	**mg/kg**	**SD-06: 0.5-1.5 ft BGS (9/25/2018)**	**27/27**	**--**	**39**	**--**	**N**	**Y**	**BIO**
57-12-5	Cyanide (total)	0.58 J	2.6	mg/kg	SD-15: 0-0.5 ft BGS (9/26/2018)	6/27	0.24 - 1.1	2.6	--	N	N	NOTBIO
7439-89-6	Iron	5600	25000	mg/kg	SD-10: 0-0.5 ft BGS (9/25/2018)	27/27	--	25000	--	N	N	NOTBIO
7439-92-1	**Lead**	**3.2**	**140**	**mg/kg**	**SD-01: 0-0.5 ft BGS (9/25/2018)**	**27/27**	**--**	**140**	**--**	**C**	**Y**	**BIO**
7439-95-4	Magnesium	14000	63000	mg/kg	SD-16: 0-0.5 ft BGS (9/26/2018)	27/27	--	63000	--		N	NOTBIO, NAT
7439-96-5	Manganese	240	1000	mg/kg	SD-11: 0.5-1.5 ft BGS (9/25/2018)	27/27	--	1000	--	N	N	NOTBIO
7439-97-6	Mercury	0.049 J	0.17 J	mg/kg	SD-04: 0.5-1.5 ft BGS (9/21/2018)	20/27	0.021 - 0.1	0.17	--	N	N	NOTBIO
22967-92-6	**Methyl mercury**	**0.00014 J**	**0.00069**	**mg/kg**	**SD-14: 0-0.5 ft BGS (9/26/2018)**	**15/27**	**.000087 - 0.0004**	**0.00069**	**--**	**N**	**Y**	**BIO**
7440-02-0	**Nickel**	**4.1**	**26**	**mg/kg**	**SD-11: 0.5-1.5 ft BGS (9/25/2018)**	**27/27**	**--**	**26**	**--**	**N**	**Y**	**BIO**
7440-09-7	Potassium	28	2000 J	mg/kg	SD-10: 0-0.5 ft BGS (9/25/2018)	27/27	--	2000	--		N	NOTBIO, NAT
7782-49-2	**Selenium**	**0.14 J**	**1.8 J**	**mg/kg**	**SD-03: 0-0.5 ft BGS (9/21/2018)**	**26/27**	**0.12 - 0.16**	**1.8**	**--**	**N**	**Y**	**BIO**
7440-22-4	**Silver**	**0.049 J**	**0.35 J**	**mg/kg**	**SD-07: 0-0.5 ft BGS (9/25/2018)**	**22/27**	**0.022 - 0.12**	**0.35**	**--**	**N**	**Y**	**BIO**
7440-23-5	Sodium	120 J	380 J	mg/kg	SD-03: 0-0.5 ft BGS (9/21/2018)	27/27	--	380	--		N	NOTBIO, NAT
7440-28-0	Thallium	0.073 J	0.55 J	mg/kg	SD-10: 0-0.5 ft BGS (9/25/2018)	27/27	--	0.55	--	N	N	NOTBIO
7440-62-2	Vanadium	6.1	29	mg/kg	SD-10: 0-0.5 ft BGS (9/25/2018)	27/27	--	29	--	N	N	NOTBIO
7440-66-6	**Zinc**	**13**	**390**	**mg/kg**	**SD-06: 0.5-1.5 ft BGS (9/25/2018)**	**27/27**	**--**	**390**	**--**	**N**	**Y**	**BIO**
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/27	26 - 120	N/A	--	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/27	29 - 130	N/A	--	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/27	28 - 130	N/A	--	C	N	ND
53469-21-9	**Aroclor-1242 (PCB-1242)**	**43 J**	**130 J**	**µg/kg**	**SD-13: 0-0.5 ft BGS (9/25/2018)**	**10/27**	**23 - 100**	**130**	**--**	**C**	**Y**	**BIO**
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/27	29 - 130	N/A	--	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**69 J**	**420**	**µg/kg**	**SD-17: 0-0.5 ft BGS (9/21/2018)**	**4/27**	**28 - 130**	**420**	**--**	**C**	**Y**	**BIO**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/27	26 - 120	N/A	--	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/27	2 - 540	N/A	--	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/kg	--	0/27	1.8 - 49	N/A	--	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/kg	--	0/27	1.5 - 410	N/A	--	C	N	ND
309-00-2	Aldrin	ND	ND	µg/kg	--	0/27	0.92 - 25	N/A	--	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/27	1.2 - 330	N/A	--	C	N	ND
5103-71-9	**alpha-Chlordane**	**5.5 J**	**5.5 J**	**µg/kg**	**SD-05: 0.5-1.5 ft BGS (9/21/2018)**	**1/27**	**1.8 - 48**	**5.5**	**--**	**C**	**Y**	**BIO**
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/27	2.1 - 56	N/A	--	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/26	40 - 970	N/A	--	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/27	1.3 - 35	N/A	--	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/27	1.4 - 39	N/A	--	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/27	1.8 - 48	N/A	--	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/27	1.7 - 470	N/A	--	N	N	ND
72-20-8	Endrin	ND	ND	µg/kg	--	0/27	2.3 - 61	N/A	--	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/kg	--	0/27	1.6 - 760	N/A	--	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/27	1.1 - 180	N/A	--	N	N	ND

Table 2.43

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Sediment Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/27	2.4 - 650	N/A	--	C	N	ND
5103-74-2	**gamma-Chlordane**	**2.3 J**	**12 J**	**µg/kg**	**SD-14: 0-0.5 ft BGS (9/26/2018)**	**5/27**	**1.5 - 40**	**12**	**--**	**C**	**Y**	**BIO**
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/27	1.9 - 51	N/A	--	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/27	1.7 - 46	N/A	--	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/27	7.9 - 1300	N/A	--	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/kg	--	0/27	30 - 800	N/A	--	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/27	16 - 74	N/A	--	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/27	17 - 80	N/A	--	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/27	59 - 280	N/A	--	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SD-01, SD-02, SD-03, SD-04, SD-05, SD-06, SD-07, SD-08, SD-10, SD-11, SD-12, SD-13, SD-14, SD-15, SD-16, SD-17, SD-18, SD-19, SD-20.

(3) Rationale Codes

Selection Reason :	Chemical detected and considered bioaccumulative according to USEPA (2000) (BIO).
Deletion Reason :	Analyte not considered bioaccumulative according to USEPA (2000) (NOTBIO).
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.

References:

USEPA. 2000. Bioaccumulation Testing and Interpretation for the Purpose of Sediment Quality Assessment. Table 4-2.

Table 2.44

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Surface Water

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/L	--	0/32	0.24	N/A	39200	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/L	--	0/32	0.13	N/A	6.51	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/L	--	0/32	0.09	N/A	29.3	C	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/L	--	0/32	0.17	N/A	274	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/L	--	0/32	0.19	N/A	1100	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	0.41 J	0.41 J	µg/L	SW-1 (9/18/2018)	1/32	0.26	0.41	6.7	N	N	BSV
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/L	--	0/32	0.0086	N/A	0.359	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/L	--	0/32	0.0087	N/A	0.94	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/L	--	0/32	0.15	N/A	726	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/L	--	0/32	0.21	N/A	20.9	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/L	--	0/32	0.15	N/A	38.9	C	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/L	--	0/32	0.15	N/A	726 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/L	--	0/32	0.16	N/A	64.7	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	2.9 J	2.9 J	µg/L	SW-1 (9/18/2018)	1/32	1.2	2.9	22700	N	N	BSV
591-78-6	2-Hexanone	1.1 J	1.1 J	µg/L	SW-1 (9/18/2018)	1/32	0.54	1.1	160	N	N	BSV
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.88 J	0.88 J	µg/L	SW-1 (9/18/2018)	1/32	0.42	0.88	630	N	N	BSV
67-64-1	Acetone	5.4 J	36	µg/L	SW-7 (9/20/2018)	3/32	5.4 - 13	36	35100	N	N	BSV
71-43-2	Benzene	0.21 J	0.21 J	µg/L	SW-1 (9/18/2018)	1/32	0.13 - 0.36	0.21	19	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/L	--	0/32	0.17	N/A	27.8	C	N	ND
75-25-2	Bromoform	ND	ND	µg/L	--	0/32	0.76	N/A	215	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/L	--	0/32	0.42	N/A	46.9	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/L	--	0/32	0.28	N/A	2290	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/L	--	0/32	0.26	N/A	11.1	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/L	--	0/32	0.14	N/A	260	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/L	--	0/32	0.83	N/A	--		N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/L	--	0/32	0.13	N/A	48.1	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/L	--	0/32	0.2	N/A	--		N	ND
156-59-2	cis-1,2-Dichloroethene	0.21 J	0.23 J	µg/L	SW-2 (10/2/2019)	3/32	0.16	0.23	45.1	N	N	BSV
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/L	--	0/32	0.61	N/A	13.7	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/L	--	0/32	0.24	N/A	--		N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/L	--	0/32	0.39	N/A	20.9	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/L	--	0/32	0.35	N/A	4720	N	N	ND
100-41-4	Ethylbenzene	0.11 J	0.34 J	µg/L	SW-1 (9/18/2018)	4/32	0.11	0.34	36.1	C	N	BSV
98-82-8	Isopropyl benzene	ND	ND	µg/L	--	0/32	0.09	N/A	523	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/L	--	0/32	1.7	N/A	38300	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/L	--	0/32	0.33	N/A	--		N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/L	--	0/32	0.07	N/A	1300	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/L	--	0/32	2.6	N/A	194	C	N	ND
100-42-5	Styrene	ND	ND	µg/L	--	0/32	0.1	N/A	2210	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/L	--	0/32	0.15	N/A	56.1	C	N	ND
108-88-3	Toluene	0.15 J	3.6	µg/L	SW-2 (9/19/2018)	17/32	0.14	3.6	1030	N	N	BSV

Table 2.44

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Surface Water

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/L	--	0/32	0.19	N/A	451	N	N	ND
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/L	--	0/32	0.67	N/A	13.7	C	N	ND
79-01-6	Trichloroethene	0.14 J	0.35 J	µg/L	SW-2 (10/2/2019)	6/32	0.1	0.35	10.3	N	N	BSV
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/L	--	0/32	0.45	N/A	5790	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/L	--	0/32	0.41	N/A	404000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/L	--	0/32	0.2	N/A	0.0561	C	N	ND
1330-20-7	Xylenes (total)	0.15 J	1.8 J	µg/L	SW-1 (9/18/2018)	15/32	0.15	1.8	1770	N	N	BSV
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/L	--	0/32	0.52 - 1.1	N/A	905	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/L	--	0/32	1.9 - 4	N/A	747	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/L	--	0/32	1.7 - 3.6	N/A	7.75	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/L	--	0/32	0.25 - 0.52	N/A	40.3	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/L	--	0/32	0.49 - 1	N/A	432	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/L	--	0/32	5.9 - 12	N/A	66.8	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/L	--	0/32	2 - 4.1	N/A	5.91	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/L	--	0/32	2 - 4.3	N/A	1.13	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/L	--	0/32	0.46 - 0.97	N/A	390	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/L	--	0/32	0.26 - 0.55	N/A	122	N	N	ND
91-57-6	2-Methylnaphthalene	0.12 J	0.15 J	µg/L	SW-7 (10/3/2019)	4/32	0.11 - 0.22	0.15	18	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/L	--	0/32	0.2 - 0.42	N/A	1280	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/L	--	0/32	0.49 - 1	N/A	291	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/L	--	0/32	0.54 - 1.1	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/L	--	0/32	0.18 - 0.38	N/A	1270 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/L	--	0/32	1.1 - 2.3	N/A	1.29	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/L	--	0/32	0.54 - 1.1	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/L	--	0/32	2.7 - 5.6	N/A	2.33	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/L	--	0/32	0.48 - 1	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/L	--	0/32	0.28 - 0.59	N/A	1150	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/L	--	0/31	0.3 - 0.63	N/A	8.5	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/L	--	0/32	0.52 - 1.1	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/L	--	0/32	0.87 - 1.8	N/A	110	C	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/L	--	0/32	2.1 - 4.3	N/A	--		N	ND
83-32-9	Acenaphthene	ND	ND	µg/L	--	0/32	0.16 - 0.34	N/A	264	N	N	ND
208-96-8	Acenaphthylene	ND	ND	µg/L	--	0/32	0.12 - 0.25	N/A	264 (5)	N	N	ND
98-86-2	Acetophenone	ND	ND	µg/L	--	0/32	0.35 - 0.73	N/A	3110	N	N	ND
120-12-7	Anthracene	ND	ND	µg/L	--	0/32	0.13 - 0.27	N/A	745	N	N	ND
1912-24-9	Atrazine	ND	ND	µg/L	--	0/32	0.91 - 1.9	N/A	5.57	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/L	--	0/32	0.72 - 1.5	N/A	487	C	N	ND
56-55-3	Benzo(a)anthracene	ND	ND	µg/L	--	0/32	0.16 - 0.34	N/A	7.18	C	N	ND
50-32-8	Benzo(a)pyrene	ND	ND	µg/L	--	0/32	0.16 - 0.35	N/A	0.718	C	N	ND

Table 2.44

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Surface Water

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
205-99-2	Benzo(b)fluoranthene	ND	ND	µg/L	--	0/32	0.15 - 0.31	N/A	7.18	C	N	ND
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/L	--	0/32	0.17 - 0.36	N/A	46.2 (5)	N	N	ND
207-08-9	Benzo(k)fluoranthene	ND	ND	µg/L	--	0/32	0.13 - 0.28	N/A	71.8	C	N	ND
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/L	--	0/32	0.47 - 0.98	N/A	21.1	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/L	--	0/32	0.43 - 0.91	N/A	107	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/L	--	0/32	0.38 - 0.8	N/A	2.1	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ND	ND	µg/L	--	0/32	2.1 - 4.4	N/A	214	C	N	ND
85-68-7	Butyl benzylphthalate (BBP)	7.9 J	7.9 J	µg/L	SW-10 (9/18/2018)	1/32	0.63 - 1.3	7.9	90.2	C	N	BSV
105-60-2	Caprolactam	ND	ND	µg/L	--	0/30	0.89 - 1.9	N/A	18700	N	N	ND
86-74-8	Carbazole	ND	ND	µg/L	--	0/32	0.47 - 0.98	N/A	--		N	ND
218-01-9	Chrysene	ND	ND	µg/L	--	0/32	0.18 - 0.37	N/A	718	C	N	ND
53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/L	--	0/32	0.14 - 0.3	N/A	0.718	C	N	ND
132-64-9	Dibenzofuran	ND	ND	µg/L	--	0/32	0.53 - 1.1	N/A	3.73	N	N	ND
84-66-2	Diethyl phthalate	ND	ND	µg/L	--	0/32	3.6 - 7.6	N/A	21300	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/L	--	0/32	0.49 - 1	N/A	21300 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/L	--	0/32	1.7 - 3.6	N/A	461	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/L	--	0/32	0.78 - 1.6	N/A	403	N	N	ND
206-44-0	Fluoranthene	ND	ND	µg/L	--	0/32	0.15 - 0.32	N/A	1610	N	N	ND
86-73-7	Fluorene	ND	ND	µg/L	--	0/32	0.16 - 0.34	N/A	135	N	N	ND
118-74-1	Hexachlorobenzene	ND	ND	µg/L	--	0/32	0.15 - 0.32	N/A	1.87	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	--	0/32	0.52 - 1.1	N/A	1.48	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	--	0/32	1.7 - 3.5	N/A	12.5	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/L	--	0/32	0.38 - 0.79	N/A	3.76	N	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	ND	ND	µg/L	--	0/32	0.13 - 0.27	N/A	7.18	C	N	ND
78-59-1	Isophorone	ND	ND	µg/L	--	0/32	0.31 - 0.65	N/A	2000	C	N	ND
91-20-3	Naphthalene	0.15 J	1.1	µg/L	SW-7 (10/3/2019)	9/32	0.1 - 0.22	1.1	171	N	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/L	--	0/32	0.49 - 1	N/A	56.2	N	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/L	--	0/32	0.24 - 0.51	N/A	0.314	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/L	--	0/32	0.42 - 0.88	N/A	142	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/L	--	0/32	3 - 6.2	N/A	0.181	C	N	ND
85-01-8	Phenanthrene	ND	ND	µg/L	--	0/32	0.16 - 0.33	N/A	46.2 (5)	N	N	ND
108-95-2	Phenol	0.32 J	0.32 J	µg/L	SW-2 (10/2/2019)	1/32	0.12 - 0.26	0.32	9230	N	N	BSV
129-00-0	Pyrene	ND	ND	µg/L	--	0/32	0.17 - 0.35	N/A	46.2	N	N	ND
	Metals											
7429-90-5	Aluminum	37 J	110	µg/L	SW-3 (9/20/2018)	6/32	34	110	38300	N	N	BSV
7440-36-0	Antimony	0.78 J	0.82 J	µg/L	SW-6 (10/3/2019)	3/32	0.57	0.82	11.9	N	N	BSV
7440-38-2	**Arsenic**	**1.6 J**	**14**	**µg/L**	**SW-2 (9/19/2018)**	**32/32**	**--**	**14**	**1.82**	**C**	**Y**	**ASV**
7440-39-3	Barium	65	250	µg/L	SW-2 (9/19/2018)	32/32	--	250	4590	N	N	BSV
7440-41-7	Beryllium	0.47 J	0.67 J	µg/L	SW-1 (9/18/2018)	5/32	0.31 - 0.65	0.67	9.41	N	N	BSV
7440-43-9	Cadmium	ND	ND	µg/L	--	0/32	0.2 - 0.21	N/A	9.79	N	N	ND
7440-70-2	Calcium	35000	80000	µg/L	SW-2 (9/19/2018)	32/32	--	80000	--		N	NAT

Table 2.44

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Surface Water

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
7440-47-3	Chromium	ND	ND	µg/L	--	0/32	0.98	N/A	0.21 (6)	C	N	ND
7440-48-4	Cobalt	0.60 J	0.67 J	µg/L	SW-2 (10/2/2019)	3/32	0.19	0.67	11.9	N	N	BSV
7440-50-8	Copper	ND	ND	µg/L	--	0/32	1.7	N/A	1530	N	N	ND
57-12-5	Cyanide (total)	ND	ND	µg/L	--	0/32	0.006	N/A	23	N	N	ND
7439-89-6	Iron	47 J	7400	µg/L	SW-2 (9/19/2018)	14/32	47	7400	26800	N	N	BSV
7439-92-1	Lead	ND	ND	µg/L	--	0/32	0.45	N/A	--	C	N	ND
7439-95-4	Magnesium	23000	32000	µg/L	SW-2 (9/19/2018)	32/32	--	32000	--		N	NAT
7439-96-5	**Manganese**	**3.6 J**	**3000**	**µg/L**	**SW-2 (10/2/2019)**	**32/32**	**--**	**3000**	**416**	**N**	**Y**	**ASV**
7439-97-6	Mercury	ND	ND	µg/L	--	0/32	0.13	N/A	--	N	N	ND
7440-02-0	Nickel	1.6 J	1.6 J	µg/L	SW-2 (10/2/2019)	1/32	1.5	1.6	638	N	N	BSV
7440-09-7	Potassium	4900	6500	µg/L	SW-2 (9/19/2018)	32/32	--	6500	--		N	NAT
7782-49-2	Selenium	1.0 J	1.0 J	µg/L	SW-8 (10/3/2019)	1/32	0.89	1	192	N	N	BSV
7440-22-4	Silver	ND	ND	µg/L	--	0/32	0.053	N/A	112	N	N	ND
7440-23-5	Sodium	17000	27000	µg/L	SW-2 (9/19/2018)	32/32	--	27000	--		N	NAT
7440-28-0	**Thallium**	**0.23 J**	**0.55 J**	**µg/L**	**SW-1 (10/2/2019)**	**2/32**	**0.2 - 0.82**	**0.55**	**0.383**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	0.89 J	1.4 J	µg/L	SW-2 (9/19/2018)	3/32	0.82	1.4	66.9	N	N	BSV
7440-66-6	Zinc	ND	ND	µg/L	--	0/32	15	N/A	11700	N	N	ND
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/L	--	0/32	0.053 - 0.58	N/A	2.82	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/L	--	0/32	0.054 - 0.59	N/A	0.0405	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/L	--	0/32	0.07 - 0.76	N/A	0.0405	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/L	--	0/32	0.072 - 0.78	N/A	1.5	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/L	--	0/32	0.048 - 0.52	N/A	1.5	C	N	ND
11097-69-1	Aroclor-1254 (PCB-1254)	0.074 J	0.074 J	µg/L	SW-2 (9/19/2018)	1/32	0.038 - 0.41	0.071	0.807	C	N	BSV
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/L	--	0/32	0.044 - 0.47	N/A	1.5	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/L	--	0/32	0.005 - 0.27	N/A	0.0221	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/L	--	0/32	0.0041 - 0.22	N/A	8.8	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/L	--	0/32	0.0046 - 0.25	N/A	8.8	C	N	ND
309-00-2	Aldrin	ND	ND	µg/L	--	0/32	0.0023 - 0.12	N/A	0.176	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/L	--	0/32	0.0019 - 0.1	N/A	0.0548	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/L	--	0/32	0.003 - 0.16	N/A	0.126	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/L	--	0/32	0.0044 - 0.24	N/A	0.192	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/L	--	0/32	0.0041 - 0.22	N/A	0.192	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/L	--	0/32	0.0022 - 0.11	N/A	0.00922	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/L	--	0/32	0.0035 - 0.18	N/A	110	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/L	--	0/32	0.0022 - 0.12	N/A	110	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/L	--	0/32	0.0035 - 0.19	N/A	132	N	N	ND

Table 2.44

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Surface Water

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/L	--	0/32	0.0024 - 0.12	N/A	1.07	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/L	--	0/32	0.0044 - 0.24	N/A	1.07	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/L	--	0/32	0.0038 - 0.21	N/A	1.07	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/L	--	0/32	0.0024 - 0.13	N/A	0.314	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/L	--	0/32	0.0048 - 0.25	N/A	0.126	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/L	--	0/32	0.0031 - 0.16	N/A	0.00816	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/L	--	0/32	0.0025 - 0.13	N/A	0.0234	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/L	--	0/32	0.0045 - 0.24	N/A	17.1	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/L	--	0/32	0.055 - 2.8	N/A	2.72	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/L	--	0/32	0.057 - 0.57	N/A	164	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/L	--	0/32	0.43	N/A	84.8	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/L	--	0/32	2.2	N/A	208	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.
(2) Based on data collected from 2013 - 2018 in sampling locations: SW-1, SW-2, SW-3, SW-4, SW-5, SW-6, SW-7, SW-8, SW-9, SW-10, SW-11, SW-12.
(3) Regional Screening Level (RSL) Calculator (TR = 1E-06, HI = 0.1) for Surface Water, Recreational User, accessed on February 3, 2020.
(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

(6) The RSL for chromium is based on chromium VI.

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
N - Tentatively identified compound.

Table 2.45

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/L	--	0/32	0.24	N/A	200000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/L	--	0/32	0.13	N/A	3	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/L	--	0/32	0.09	N/A	8.9	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/L	--	0/32	0.17	N/A	--	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/L	--	0/32	0.19	N/A	20000	N	N	ND
120-82-1	**1,2,4-Trichlorobenzene**	**0.41 J**	**0.41 J**	**µg/L**	**SW-1 (9/18/2018)**	**1/32**	**0.26**	**0.41**	**0.076**	**N**	**Y**	**ASV**
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/L	--	0/32	0.0086	N/A	--	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/L	--	0/32	0.0087	N/A	--	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/L	--	0/32	0.15	N/A	3000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/L	--	0/32	0.21	N/A	650	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/L	--	0/32	0.15	N/A	31	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/L	--	0/32	0.15	N/A	10	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/L	--	0/32	0.16	N/A	900	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	2.9 J	2.9 J	µg/L	SW-1 (9/18/2018)	1/32	1.2	2.9	--	N	N	NOT BIO
591-78-6	2-Hexanone	1.1 J	1.1 J	µg/L	SW-1 (9/18/2018)	1/32	0.54	1.1	--	N	N	NOT BIO
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	0.88 J	0.88 J	µg/L	SW-1 (9/18/2018)	1/32	0.42	0.88	--	N	N	NOT BIO
67-64-1	Acetone	5.4 J	36	µg/L	SW-7 (9/20/2018)	3/32	5.4 - 13	36	--	N	N	NOT BIO
71-43-2	Benzene	0.21 J	0.21 J	µg/L	SW-1 (9/18/2018)	1/32	0.13 - 0.36	0.21	16	C	N	BSV
75-27-4	Bromodichloromethane	ND	ND	µg/L	--	0/32	0.17	N/A	27	C	N	ND
75-25-2	Bromoform	ND	ND	µg/L	--	0/32	0.76	N/A	120	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/L	--	0/32	0.42	N/A	10000	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/L	--	0/32	0.28	N/A	--	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/L	--	0/32	0.26	N/A	5	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/L	--	0/32	0.14	N/A	800	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/L	--	0/32	0.83	N/A	--	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/L	--	0/32	0.13	N/A	2000	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/L	--	0/32	0.2	N/A	--	N	N	ND
156-59-2	cis-1,2-Dichloroethene	0.21 J	0.23 J	µg/L	SW-2 (10/2/2019)	3/32	0.16	0.23	--	N	N	NOT BIO
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/L	--	0/32	0.61	N/A	12	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/L	--	0/32	0.24	N/A	--	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/L	--	0/32	0.39	N/A	21	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/L	--	0/32	0.35	N/A	--	N	N	ND
100-41-4	Ethylbenzene	0.11 J	0.34 J	µg/L	SW-1 (9/18/2018)	4/32	0.11	0.34	130	C	N	BSV
98-82-8	Isopropyl benzene	ND	ND	µg/L	--	0/32	0.09	N/A	--	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/L	--	0/32	1.7	N/A	--	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/L	--	0/32	0.33	N/A	--	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/L	--	0/32	0.07	N/A	--	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/L	--	0/32	2.6	N/A	1000	C	N	ND
100-42-5	Styrene	ND	ND	µg/L	--	0/32	0.1	N/A	--	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/L	--	0/32	0.15	N/A	29	C	N	ND

Table 2.45

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
108-88-3	Toluene	0.15 J	3.6	µg/L	SW-2 (9/19/2018)	17/32	0.14	3.6	520	N	N	BSV
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/L	--	0/32	0.19	N/A	4000	N	N	ND
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/L	--	0/32	0.67	N/A	12	C	N	ND
79-01-6	Trichloroethene	0.14 J	0.35 J	µg/L	SW-2 (10/2/2019)	6/32	0.1	0.35	7	N	N	BSV
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/L	--	0/32	0.45	N/A	--	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/L	--	0/32	0.41	N/A	--	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/L	--	0/32	0.2	N/A	1.6	C	N	ND
1330-20-7	Xylenes (total)	0.15 J	1.8 J	µg/L	SW-1 (9/18/2018)	15/32	0.15	1.8	--	N	N	NOT BIO
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/L	--	0/32	0.52 - 1.1	N/A	4000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/L	--	0/32	1.9 - 4	N/A	600	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/L	--	0/32	1.7 - 3.6	N/A	2.8	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/L	--	0/32	0.25 - 0.52	N/A	60	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/L	--	0/32	0.49 - 1	N/A	3000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/L	--	0/32	5.9 - 12	N/A	300	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/L	--	0/32	2 - 4.1	N/A	1.7	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/L	--	0/32	2 - 4.3	N/A	--	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/L	--	0/32	0.46 - 0.97	N/A	1000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/L	--	0/32	0.26 - 0.55	N/A	800	N	N	ND
91-57-6	2-Methylnaphthalene	0.12 J	0.15 J	µg/L	SW-7 (10/3/2019)	4/32	0.11 - 0.22	0.15	--	N	N	NOT BIO
95-48-7	2-Methylphenol	ND	ND	µg/L	--	0/32	0.2 - 0.42	N/A	--	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/L	--	0/32	0.49 - 1	N/A	--	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/L	--	0/32	0.54 - 1.1	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/L	--	0/32	0.18 - 0.38	N/A	--	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/L	--	0/32	1.1 - 2.3	N/A	0.15	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/L	--	0/32	0.54 - 1.1	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/L	--	0/32	2.7 - 5.6	N/A	30	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/L	--	0/32	0.48 - 1	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/L	--	0/32	0.28 - 0.59	N/A	2000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/L	--	0/31	0.3 - 0.63	N/A	--	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/L	--	0/32	0.52 - 1.1	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/L	--	0/32	0.87 - 1.8	N/A	--	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/L	--	0/32	2.1 - 4.3	N/A	--		N	ND
83-32-9	Acenaphthene	ND	ND	µg/L	--	0/32	0.16 - 0.34	N/A	90	N	N	ND
208-96-8	Acenaphthylene	ND	ND	µg/L	--	0/32	0.12 - 0.25	N/A	90 (5)	N	N	ND
98-86-2	Acetophenone	ND	ND	µg/L	--	0/32	0.35 - 0.73	N/A	--	N	N	ND
120-12-7	Anthracene	ND	ND	µg/L	--	0/32	0.13 - 0.27	N/A	400	N	N	ND
1912-24-9	Atrazine	ND	ND	µg/L	--	0/32	0.91 - 1.9	N/A	--	C	N	ND
100-52-7	Benzaldehyde	ND	ND	µg/L	--	0/32	0.72 - 1.5	N/A	--	N	N	ND

Table 2.45

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
56-55-3	Benzo(a)anthracene	ND	ND	µg/L	--	0/32	0.16 - 0.34	N/A	0.0013	C	N	ND
50-32-8	Benzo(a)pyrene	ND	ND	µg/L	--	0/32	0.16 - 0.35	N/A	0.00013	C	N	ND
205-99-2	Benzo(b)fluoranthene	ND	ND	µg/L	--	0/32	0.15 - 0.31	N/A	0.0013	C	N	ND
191-24-2	Benzo(g,h,i)perylene	ND	ND	µg/L	--	0/32	0.17 - 0.36	N/A	30 (5)	N	N	ND
207-08-9	Benzo(k)fluoranthene	ND	ND	µg/L	--	0/32	0.13 - 0.28	N/A	0.013	C	N	ND
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/L	--	0/32	0.47 - 0.98	N/A	--	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/L	--	0/32	0.43 - 0.91	N/A	--	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/L	--	0/32	0.38 - 0.8	N/A	2.2	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	ND	ND	µg/L	--	0/32	2.1 - 4.4	N/A	0.37	C	N	ND
85-68-7	**Butyl benzylphthalate (BBP)**	**7.9 J**	**7.9 J**	**µg/L**	**SW-10 (9/18/2018)**	**1/32**	**0.63 - 1.3**	**7.9**	**0.1**	**C**	**Y**	**ASV**
105-60-2	Caprolactam	ND	ND	µg/L	--	0/30	0.89 - 1.9	N/A	--	N	N	ND
86-74-8	Carbazole	ND	ND	µg/L	--	0/32	0.47 - 0.98	N/A	--		N	ND
218-01-9	Chrysene	ND	ND	µg/L	--	0/32	0.18 - 0.37	N/A	0.13	C	N	ND
53-70-3	Dibenz(a,h)anthracene	ND	ND	µg/L	--	0/32	0.14 - 0.3	N/A	0.00013	C	N	ND
132-64-9	Dibenzofuran	ND	ND	µg/L	--	0/32	0.53 - 1.1	N/A	--	N	N	ND
84-66-2	Diethyl phthalate	ND	ND	µg/L	--	0/32	3.6 - 7.6	N/A	600	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/L	--	0/32	0.49 - 1	N/A	2000	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	ND	ND	µg/L	--	0/32	1.7 - 3.6	N/A	30	N	N	ND
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/L	--	0/32	0.78 - 1.6	N/A	--	N	N	ND
206-44-0	Fluoranthene	ND	ND	µg/L	--	0/32	0.15 - 0.32	N/A	20	N	N	ND
86-73-7	Fluorene	ND	ND	µg/L	--	0/32	0.16 - 0.34	N/A	70	N	N	ND
118-74-1	Hexachlorobenzene	ND	ND	µg/L	--	0/32	0.15 - 0.32	N/A	0.000079	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/L	--	0/32	0.52 - 1.1	N/A	0.01	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/L	--	0/32	1.7 - 3.5	N/A	4	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/L	--	0/32	0.38 - 0.79	N/A	0.1	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	ND	ND	µg/L	--	0/32	0.13 - 0.27	N/A	0.0013	C	N	ND
78-59-1	Isophorone	ND	ND	µg/L	--	0/32	0.31 - 0.65	N/A	1800	C	N	ND
91-20-3	Naphthalene	0.15 J	1.1	µg/L	SW-7 (10/3/2019)	9/32	0.1 - 0.22	1.1	--	C	N	NOT BIO
98-95-3	Nitrobenzene	ND	ND	µg/L	--	0/32	0.49 - 1	N/A	600	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/L	--	0/32	0.24 - 0.51	N/A	0.51	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/L	--	0/32	0.42 - 0.88	N/A	6	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/L	--	0/32	3 - 6.2	N/A	0.04	C	N	ND
85-01-8	Phenanthrene	ND	ND	µg/L	--	0/32	0.16 - 0.33	N/A	30 (5)	N	N	ND
108-95-2	Phenol	0.32 J	0.32 J	µg/L	SW-2 (10/2/2019)	1/32	0.12 - 0.26	0.32	300000	N	N	BSV
129-00-0	Pyrene	ND	ND	µg/L	--	0/32	0.17 - 0.35	N/A	30	N	N	ND
	Metals											
7429-90-5	Aluminum	37 J	110	µg/L	SW-3 (9/20/2018)	6/32	34	110	--	N	N	NOT BIO
7440-36-0	Antimony	0.78 J	0.82 J	µg/L	SW-6 (10/3/2019)	3/32	0.57	0.82	640	N	N	BSV
7440-38-2	**Arsenic**	**1.6 J**	**14**	**µg/L**	**SW-2 (9/19/2018)**	**32/32**	**--**	**14**	**0.14**	**C**	**Y**	**ASV**
7440-39-3	Barium	65	250	µg/L	SW-2 (9/19/2018)	32/32	--	250	--	N	N	NOT BIO

Table 2.45

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
7440-41-7	Beryllium	0.47 J	0.67 J	µg/L	SW-1 (9/18/2018)	5/32	0.31 - 0.65	0.67	--	N	N	NOT BIO
7440-43-9	Cadmium	ND	ND	µg/L	--	0/32	0.2 - 0.21	N/A	--	N	N	ND
7440-70-2	Calcium	35000	80000	µg/L	SW-2 (9/19/2018)	32/32	--	80000	--		N	NAT
7440-47-3	Chromium	ND	ND	µg/L	--	0/32	0.98	N/A	--	C	N	ND
7440-48-4	Cobalt	0.60 J	0.67 J	µg/L	SW-2 (10/2/2019)	3/32	0.19	0.67	--	N	N	NOT BIO
7440-50-8	Copper	ND	ND	µg/L	--	0/32	1.7	N/A	--	N	N	ND
57-12-5	Cyanide (total)	ND	ND	µg/L	--	0/32	0.006	N/A	400	N	N	ND
7439-89-6	Iron	47 J	7400	µg/L	SW-2 (9/19/2018)	14/32	47	7400	--	N	N	NOT BIO
7439-92-1	Lead	ND	ND	µg/L	--	0/32	0.45	N/A	--	C	N	ND
7439-95-4	Magnesium	23000	32000	µg/L	SW-2 (9/19/2018)	32/32	--	32000	--		N	NAT
7439-96-5	**Manganese**	**3.6 J**	**3000**	**µg/L**	**SW-2 (10/2/2019)**	**32/32**	**--**	**3000**	**100**	**N**	**Y**	**ASV**
7439-97-6	Mercury	ND	ND	µg/L	--	0/32	0.13	N/A	--	N	N	ND
7440-02-0	Nickel	1.6 J	1.6 J	µg/L	SW-2 (10/2/2019)	1/32	1.5	1.6	4600	N	N	BSV
7440-09-7	Potassium	4900	6500	µg/L	SW-2 (9/19/2018)	32/32	--	6500	--		N	NAT
7782-49-2	Selenium	1.0 J	1.0 J	µg/L	SW-8 (10/3/2019)	1/32	0.89	1	4200	N	N	BSV
7440-22-4	Silver	ND	ND	µg/L	--	0/32	0.053	N/A	--	N	N	ND
7440-23-5	Sodium	17000	27000	µg/L	SW-2 (9/19/2018)	32/32	--	27000	--		N	NAT
7440-28-0	**Thallium**	**0.23 J**	**0.55 J**	**µg/L**	**SW-1 (10/2/2019)**	**2/32**	**0.2 - 0.82**	**0.55**	**0.47**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	0.89 J	1.4 J	µg/L	SW-2 (9/19/2018)	3/32	0.82	1.4	--	N	N	NOT BIO
7440-66-6	Zinc	ND	ND	µg/L	--	0/32	15	N/A	26000	N	N	ND
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/L	--	0/32	0.053 - 0.58	N/A	0.000064	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/L	--	0/32	0.054 - 0.59	N/A	0.000064	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/L	--	0/32	0.07 - 0.76	N/A	0.000064	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/L	--	0/32	0.072 - 0.78	N/A	0.000064	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/L	--	0/32	0.048 - 0.52	N/A	0.000064	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**0.074 J**	**0.074 J**	**µg/L**	**SW-2 (9/19/2018)**	**1/32**	**0.038 - 0.41**	**0.074**	**0.000064**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/L	--	0/32	0.044 - 0.47	N/A	0.000064	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/L	--	0/32	0.005 - 0.27	N/A	0.00012	C	N	ND
72-55-9	4,4'-DDE	ND	ND	µg/L	--	0/32	0.0041 - 0.22	N/A	0.000018	C	N	ND
50-29-3	4,4'-DDT	ND	ND	µg/L	--	0/32	0.0046 - 0.25	N/A	0.00003	C	N	ND
309-00-2	Aldrin	ND	ND	µg/L	--	0/32	0.0023 - 0.12	N/A	0.00000077	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/L	--	0/32	0.0019 - 0.1	N/A	0.00039	C	N	ND
5103-71-9	alpha-Chlordane	ND	ND	µg/L	--	0/32	0.003 - 0.16	N/A	0.00032	C	N	ND
319-85-7	beta-BHC	ND	ND	µg/L	--	0/32	0.0044 - 0.24	N/A	0.014	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/L	--	0/32	0.0041 - 0.22	N/A	0.01	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/L	--	0/32	0.0022 - 0.11	N/A	0.0000012	C	N	ND

Table 2.45

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Quarry Pond Surface Water Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Fish Tissue

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
959-98-8	Endosulfan I	ND	ND	µg/L	--	0/32	0.0035 - 0.18	N/A	30	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/L	--	0/32	0.0022 - 0.12	N/A	40	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/L	--	0/32	0.0035 - 0.19	N/A	40	N	N	ND
72-20-8	Endrin	ND	ND	µg/L	--	0/32	0.0024 - 0.12	N/A	0.03	N	N	ND
7421-93-4	Endrin aldehyde	ND	ND	µg/L	--	0/32	0.0044 - 0.24	N/A	1	N	N	ND
53494-70-5	Endrin ketone	ND	ND	µg/L	--	0/32	0.0038 - 0.21	N/A	--	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/L	--	0/32	0.0024 - 0.13	N/A	4.4	C	N	ND
5103-74-2	gamma-Chlordane	ND	ND	µg/L	--	0/32	0.0048 - 0.25	N/A	0.00032	C	N	ND
76-44-8	Heptachlor	ND	ND	µg/L	--	0/32	0.0031 - 0.16	N/A	0.0000059	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/L	--	0/32	0.0025 - 0.13	N/A	0.000032	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/L	--	0/32	0.0045 - 0.24	N/A	0.02	N	N	ND
8001-35-2	Toxaphene	ND	ND	µg/L	--	0/32	0.055 - 2.8	N/A	0.0071	C	N	ND
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/L	--	0/32	0.057 - 0.57	N/A	--	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/L	--	0/32	0.43	N/A	400	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/L	--	0/32	2.2	N/A	12000	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from 2013 - 2018 in sampling locations: SW-1, SW-2, SW-3, SW-4, SW-5, SW-6, SW-7, SW-8, SW-9, SW-10.

(3) National Recommended Water Quality Criteria - Human Health Criteria Table, Human Health for Consumption of Organisms only, (https://www.epa.gov/wqc/national-recommended-water-quality-criteria-human-health-criteria-table), accessed November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Chemical detected and considered bioaccumulative according to OEPA (2017) (BIO).
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte not considered bioaccumulative according to OEPA (2017) (NOTBIO).
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene

Defintions:

N/A = Not Applicable
-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
N - Tentatively identified compound.

Reference:

OEPA, 2017. Ohio Environmental Protection Agency (OEPA) Chapter 3745-1 Water Quality Standards, February 2017.

Table 2.46

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Background (Floodplain) Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: Background (Floodplain) Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/16	0.72 - 1.1	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/14	1.3 - 1.9	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/16	1 - 1.5	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/16	0.61 - 0.92	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/16	0.79 - 1.2	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/14	0.5 - 0.76	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/14	3.2 - 4.8	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/16	0.68 - 1	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/14	0.98 - 1.5	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/16	0.68 - 1	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/16	0.75 - 1.1	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/14	0.72 - 1.1	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	ND	ND	µg/kg	--	0/14	0.78 - 1.2	N/A	2600	C	N	ND
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ND	ND	µg/kg	--	0/16	3.1 - 4.7	N/A	2700000	N	N	ND
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/16	3.6 - 5.4	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/16	3.3 - 4.9	N/A	3300000	N	N	ND
67-64-1	Acetone	ND	ND	µg/kg	--	0/16	18 - 28	N/A	6100000	N	N	ND
71-43-2	Benzene	ND	ND	µg/kg	--	0/16	0.61 - 0.93	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/16	0.6 - 0.9	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/16	2.1 - 3.2	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/16	0.87 - 1.3	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/16	1 - 1.5	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/16	2.9 - 4.3	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/16	0.81 - 1.2	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/16	1.1 - 1.6	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/16	0.69 - 1	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/16	0.92 - 1.4	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/16	0.57 - 0.86	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/16	1.3 - 1.9	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/16	1.2 - 1.8	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/16	2.4 - 3.7	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/16	0.83 - 1.3	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/16	0.92 - 1.4	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/16	0.73 - 1.1	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/16	3 - 4.5	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/16	1.1 - 1.6	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/16	0.72 - 1.1	N/A	47000	C	N	ND
75-09-2	Methylene chloride	ND	ND	µg/kg	--	0/16	11 - 16	N/A	35000	N	N	ND
100-42-5	Styrene	ND	ND	µg/kg	--	0/16	1 - 1.5	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/16	0.64 - 0.97	N/A	8100	N	N	ND
108-88-3	Toluene	ND	ND	µg/kg	--	0/16	0.68 - 1	N/A	490000	N	N	ND

Table 2.46

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Background (Floodplain) Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: Background (Floodplain) Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/16	0.41 - 0.62	N/A	160000	N	N	ND
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/16	0.91 - 1.4	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/16	0.56 - 0.84	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/16	0.95 - 1.4	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/16	1.1 - 1.7	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/16	0.74 - 1.1	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/16	1.4 - 2.1	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/16	11 - 14	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/16	78 - 96	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/16	73 - 89	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/16	50 - 61	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/16	45 - 56	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/16	160 - 200	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/16	70 - 86	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/16	63 - 78	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/16	16 - 20	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/16	11 - 14	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	4.3 J	27	µg/kg	SS-202: 0.67-2.17 ft BGS (12/10/2018)	15/16	2.4	27	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/16	35 - 43	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/16	45 - 56	N/A	63000	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/16	15 - 18	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/16	33 - 40	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/16	49 - 60	N/A	1200	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/16	56 - 68	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/16	91 - 110	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/16	16 - 20	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/16	51 - 63	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/16	34 - 42	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/16	16 - 20	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/16	68 - 84	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/16	110 - 130	N/A	--		N	ND
83-32-9	Acenaphthene	9.6 J	38	µg/kg	SS-201: 0.67-2.17 ft BGS (12/10/2018)	13/16	3.6 - 3.7	38	360000	N	N	BSV
208-96-8	Acenaphthylene	6.2 J	63	µg/kg	SS-207: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	63	360000 (5)	N	N	BSV
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/16	12 - 15	N/A	780000	N	N	ND
120-12-7	Anthracene	6.9 J	130	µg/kg	SS-201: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	130	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/16	41 - 50	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	34 J	85 J	µg/kg	SS-205: 0.17-0.67 ft BGS (12/10/2018)	3/16	26 - 31	85 J	170000	N	N	BSV
56-55-3	Benzo(a)anthracene	52	500	µg/kg	SS-201: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	500	1100	C	N	BSV
50-32-8	**Benzo(a)pyrene**	**63**	**540**	**µg/kg**	**SS-202: 0.67-2.17 ft BGS (12/10/2018)**	**16/16**	**--**	**540**	**110**	**C**	**Y**	**ASV**

Table 2.46

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Background (Floodplain) Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: Background (Floodplain) Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
205-99-2	Benzo(b)fluoranthene	110	990	µg/kg	SS-202: 0.17-0.67 ft BGS (12/10/2018)	16/16	--	990	1100	C	N	BSV
191-24-2	Benzo(g,h,i)perylene	54	390	µg/kg	SS-208: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	390	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	30	380	µg/kg	SS-202: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	380	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/kg	--	0/16	19 - 24	N/A	4700	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/16	14 - 17	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/16	14 - 17	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	76 J	240	µg/kg	SS-201: 0.17-0.67 ft BGS (12/10/2018)	13/16	64 - 93	240	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	30 J	38 J	µg/kg	SS-205: 0.67-2.17 ft BGS (12/10/2018)	2/16	25 - 31	38 J	290000	C	N	BSV
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/16	85 - 100	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**29 J**	**84**	**µg/kg**	**SS-201: 0.67-2.17 ft BGS (12/10/2018)**	**14/16**	**24**	**84**	**--**		**Y**	**AD**
218-01-9	Chrysene	71	600	µg/kg	SS-202: 0.17-0.67 ft BGS (12/10/2018)	16/16	--	600	110000	C	N	BSV
53-70-3	Dibenz(a,h)anthracene	20	110	µg/kg	SS-207: 0.67-2.17 ft BGS (12/10/2018)	12/16	7.8 - 9	110	110	C	N	BSV
132-64-9	Dibenzofuran	16 J	22 J	µg/kg	SS-201: 0.67-2.17 ft BGS (12/10/2018)	4/16	15 - 18	22 J	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/16	35 - 43	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	ND	ND	µg/kg	--	0/16	16 - 20	N/A	5100000 (5)	N	N	ND
84-74-2	Di-n-butylphthalate (DBP)	28 J	30 J	µg/kg	SS-205: 0.67-2.17 ft BGS (12/10/2018)	6/16	25 - 31	30 J	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/16	32 - 39	N/A	63000	N	N	ND
206-44-0	Fluoranthene	120	1300	µg/kg	SS-201: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	1300	240000	N	N	BSV
86-73-7	Fluorene	10 J	37	µg/kg	SS-201: 0.67-2.17 ft BGS (12/10/2018)	13/16	3.4 - 3.7	37	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/16	3.2 - 4	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/16	14 - 17	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/12	71 - 86	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/16	10 - 13	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	48	350	µg/kg	SS-207: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	350	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/16	14 - 17	N/A	570000	C	N	ND
91-20-3	Naphthalene	8.9 J	22	µg/kg	SS-202: 0.67-2.17 ft BGS (12/10/2018)	13/16	2.8 - 3	22	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/16	15 - 18	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/16	12 - 15	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/16	14 - 17	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/15	66 - 81	N/A	1000	C	N	ND
85-01-8	Phenanthrene	43	610	µg/kg	SS-201: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	610	180000 (5)	N	N	BSV
108-95-2	Phenol	ND	ND	µg/kg	--	0/16	9.1 - 11	N/A	1900000	N	N	ND
129-00-0	Pyrene	98	820	µg/kg	SS-201: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	820	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**6400**	**13000**	**mg/kg**	**SS-206: 0.67-2.17 ft BGS (12/10/2018)**	**16/16**	**--**	**13000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.19 J	0.35 J	mg/kg	SS-208: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	0.35 J	3.1	N	N	BSV
7440-38-2	**Arsenic**	**6.7**	**10**	**mg/kg**	**SS-203: 0.67-2.17 ft BGS (12/10/2018)**	**16/16**	**--**	**10**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	73	150	mg/kg	SS-203: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	150	1500	N	N	BSV
7440-41-7	Beryllium	0.32	0.77	mg/kg	SS-206: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	0.77	16	N	N	BSV
7440-43-9	Cadmium	0.33	2	mg/kg	SS-208: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	2	7.1	N	N	BSV

Table 2.46

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Background (Floodplain) Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: Background (Floodplain) Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
7440-70-2	Calcium	20000	82000	mg/kg	SS-201: 0.17-0.67 ft BGS (12/10/2018)	16/16	--	82000	--		N	NAT
16065-83-1	Chromium III (trivalent)	12.9	38.6	mg/kg	SS-208: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	38.6	12000	N	N	BSV
18540-29-9	**Chromium VI (hexavalent)**	**2.14**	**6.43**	**mg/kg**	**SS-208: 0.67-2.17 ft BGS (12/10/2018)**	**16/16**	**--**	**6.43**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**5**	**13**	**mg/kg**	**SS-206: 0.17-0.67 ft BGS (12/10/2018)**	**16/16**	**--**	**13**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	15	54	mg/kg	SS-208: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	54	310	N	N	BSV
57-12-5	Cyanide (total)	0.26 J	0.29 J	mg/kg	SS-204: 0.17-0.67 ft BGS (12/10/2018)	3/16	0.2 - 0.29	0.29 J	2.3	N	N	BSV
7439-89-6	**Iron**	**13000**	**23000**	**mg/kg**	**SS-206: 0.67-2.17 ft BGS (12/10/2018)**	**16/16**	**--**	**23000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	26	77	mg/kg	SS-208: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	77	400	C	N	BSV
7439-95-4	Magnesium	8900	32000	mg/kg	SS-201: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	32000	--		N	NAT
7439-96-5	**Manganese**	**350**	**1000**	**mg/kg**	**SS-206: 0.67-2.17 ft BGS (12/10/2018)**	**16/16**	**--**	**1000**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.041 J	0.26	mg/kg	SS-207: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	0.26	1.1	N	N	BSV
7440-02-0	Nickel	15	30	mg/kg	SS-208: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	30	150	N	N	BSV
7440-09-7	Potassium	870	1600	mg/kg	SS-205: 0.17-0.67 ft BGS (12/10/2018)	16/16	--	1600	--		N	NAT
7782-49-2	Selenium	0.34 J	0.83 J	mg/kg	SS-208: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	0.83 J	39	N	N	BSV
7440-22-4	Silver	0.060 J	1.2	mg/kg	SS-208: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	1.2	39	N	N	BSV
7440-23-5	Sodium	61 J	110 J	mg/kg	SS-201: 0.17-0.67 ft BGS (12/10/2018)	15/16	59	110 J	--		N	NAT
7440-28-0	**Thallium**	**0.19**	**0.4**	**mg/kg**	**SS-208: 0.67-2.17 ft BGS (12/10/2018)**	**16/16**	**--**	**0.4**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	17	30	mg/kg	SS-206: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	30	39	N	N	BSV
7440-66-6	Zinc	60	150	mg/kg	SS-207: 0.67-2.17 ft BGS (12/10/2018)	16/16	--	150	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/24	24 - 280	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/24	26 - 300	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/24	25 - 290	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	ND	ND	µg/kg	--	0/24	20 - 240	N/A	230	C	N	ND
12672-29-6	Aroclor-1248 (PCB-1248)	ND	ND	µg/kg	--	0/24	26 - 300	N/A	230	C	N	ND
11097-69-1	**Aroclor-1254 (PCB-1254)**	**51 J**	**3300**	**µg/kg**	**SS-205: 0.67-2.17 ft BGS (12/10/2018)**	**22/24**	**28 - 29**	**3300**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/24	24 - 280	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	4.1 NJ	4.1 NJ	µg/kg	SS-204: 0.17-0.67 ft BGS (12/10/2018)	1/24	1.7 - 19	4.1 NJ	190	C	N	BSV
72-55-9	4,4'-DDE	2.0 J	4.5 J	µg/kg	SS-203: 0.17-0.67 ft BGS (12/10/2018)	2/24	1.7 - 19	4.5 J	2000	C	N	BSV
50-29-3	4,4'-DDT	1.9 NJ	17 J	µg/kg	N/A	5/24	1.3 - 14	17 J	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/24	0.87 - 9.8	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/24	1 - 12	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	2.5 J	11 J	µg/kg	N/A	2/24	1.7 - 19	11 J	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/24	1.9 - 22	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/24	1.9 - 22	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/24	1.2 - 14	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/24	1.4 - 15	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/24	1.7 - 19	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	ND	ND	µg/kg	--	0/24	1.4 - 16	N/A	38000	N	N	ND

Table 2.46

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in Background (Floodplain) Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: Background (Floodplain) Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/24	2.1 - 24	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	2.0 NJ	2.0 NJ	µg/kg	SS-203: 0.67-2.17 ft BGS (12/10/2018)	1/24	1.5 - 17	2.0 NJ	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/24	1 - 11	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	ND	ND	µg/kg	--	0/24	2 - 23	N/A	570	C	N	ND
5103-74-2	gamma-Chlordane	1.5 NJ	1.5 NJ	µg/kg	N/A	1/24	1.4 - 16	1.5 NJ	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/24	1.8 - 20	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	ND	ND	µg/kg	--	0/24	1.6 - 18	N/A	70	C	N	ND
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/24	7.4 - 84	N/A	32000	N	N	ND
8001-35-2	Toxaphene	51 J	51 J	µg/kg	N/A	1/24	28 - 320	51 J	490	C	N	BSV
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/24	14 - 18	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	ND	ND	µg/kg	--	0/24	15 - 19	N/A	51000	N	N	ND
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/24	54 - 67	N/A	70000	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.
(2) Based on data collected from sampling locations: SS-201, SS-202, SS-203, SS-204, SS-205, SS-206, SS-208.
(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.
(4) Rationale Codes

Selection Reason:	Maximum detected above Screening Value (ASV)
	Analyte Detected and no Screening Value available (AD)
Deletion Reason:	Maximum detected below Screening Value (BSV)
	Analyte Not Detected (ND)
	Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 2.47

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: EU Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds											
71-55-6	1,1,1-Trichloroethane	ND	ND	µg/kg	--	0/24	0.82 - 1.2	N/A	810000	N	N	ND
79-34-5	1,1,2,2-Tetrachloroethane	ND	ND	µg/kg	--	0/24	1.4 - 2.1	N/A	600	C	N	ND
79-00-5	1,1,2-Trichloroethane	ND	ND	µg/kg	--	0/24	1.1 - 1.7	N/A	150	N	N	ND
75-34-3	1,1-Dichloroethane	ND	ND	µg/kg	--	0/24	0.69 - 1	N/A	3.6	C	N	ND
75-35-4	1,1-Dichloroethene	ND	ND	µg/kg	--	0/24	0.9 - 1.4	N/A	23000	N	N	ND
120-82-1	1,2,4-Trichlorobenzene	ND	ND	µg/kg	--	0/24	0.57 - 2.1	N/A	5800	N	N	ND
96-12-8	1,2-Dibromo-3-chloropropane (DBCP)	ND	ND	µg/kg	--	0/24	3.6 - 5.4	N/A	5.3	C	N	ND
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	ND	ND	µg/kg	--	0/24	0.77 - 1.2	N/A	36	C	N	ND
95-50-1	1,2-Dichlorobenzene	ND	ND	µg/kg	--	0/24	1.1 - 1.7	N/A	180000	N	N	ND
107-06-2	1,2-Dichloroethane	ND	ND	µg/kg	--	0/24	0.77 - 1.2	N/A	460	C	N	ND
78-87-5	1,2-Dichloropropane	ND	ND	µg/kg	--	0/24	0.85 - 1.3	N/A	1600	N	N	ND
541-73-1	1,3-Dichlorobenzene	ND	ND	µg/kg	--	0/24	0.81 - 1.2	N/A	180000 (5)	N	N	ND
106-46-7	1,4-Dichlorobenzene	1.2 J	1.2 J	µg/kg	SS-169: 0.17-0.67 ft BGS (8/7/2018)	1/24	0.88 - 1.3	1.2	2600	C	N	BSV
78-93-3	2-Butanone (Methyl ethyl ketone) (MEK)	ND	ND	µg/kg	--	0/24	3.5 - 5.3	N/A	2700000	N	N	ND
591-78-6	2-Hexanone	ND	ND	µg/kg	--	0/24	4.1 - 6.1	N/A	20000	N	N	ND
108-10-1	4-Methyl-2-pentanone (Methyl isobutyl ketone) (MIBK)	ND	ND	µg/kg	--	0/24	3.7 - 5.6	N/A	3300000	N	N	ND
67-64-1	Acetone	22 J	140	µg/kg	SS-167: 0.67-2.17 ft BGS (8/7/2018)	6/24	21 - 32	140	6100000	N	N	BSV
71-43-2	Benzene	ND	ND	µg/kg	--	0/24	0.7 - 1	N/A	1200	C	N	ND
75-27-4	Bromodichloromethane	ND	ND	µg/kg	--	0/24	0.68 - 1	N/A	290	C	N	ND
75-25-2	Bromoform	ND	ND	µg/kg	--	0/24	2.4 - 3.6	N/A	19000	C	N	ND
74-83-9	Bromomethane (Methyl bromide)	ND	ND	µg/kg	--	0/24	0.99 - 1.5	N/A	680	N	N	ND
75-15-0	Carbon disulfide	ND	ND	µg/kg	--	0/24	1.2 - 1.7	N/A	77000	N	N	ND
56-23-5	Carbon tetrachloride	ND	ND	µg/kg	--	0/24	3.2 - 4.9	N/A	650	C	N	ND
108-90-7	Chlorobenzene	ND	ND	µg/kg	--	0/24	0.91 - 1.4	N/A	28000	N	N	ND
75-00-3	Chloroethane	ND	ND	µg/kg	--	0/24	1.2 - 1.8	N/A	1400000	N	N	ND
67-66-3	Chloroform (Trichloromethane)	ND	ND	µg/kg	--	0/24	0.79 - 1.2	N/A	320	C	N	ND
74-87-3	Chloromethane (Methyl chloride)	ND	ND	µg/kg	--	0/24	1 - 1.6	N/A	11000	N	N	ND
156-59-2	cis-1,2-Dichloroethene	ND	ND	µg/kg	--	0/24	0.65 - 0.98	N/A	16000	N	N	ND
10061-01-5	cis-1,3-Dichloropropene	ND	ND	µg/kg	--	0/24	1.4 - 2.2	N/A	1800	C	N	ND
110-82-7	Cyclohexane	ND	ND	µg/kg	--	0/24	1.4 - 2.1	N/A	650000	N	N	ND
124-48-1	Dibromochloromethane	ND	ND	µg/kg	--	0/24	2.8 - 4.2	N/A	8300	C	N	ND
75-71-8	Dichlorodifluoromethane (CFC-12)	ND	ND	µg/kg	--	0/24	0.94 - 1.4	N/A	8700	N	N	ND
100-41-4	Ethylbenzene	ND	ND	µg/kg	--	0/24	1 - 1.6	N/A	5800	C	N	ND
98-82-8	Isopropyl benzene	ND	ND	µg/kg	--	0/24	0.83 - 1.2	N/A	190000	N	N	ND
79-20-9	Methyl acetate	ND	ND	µg/kg	--	0/24	3.4 - 5.1	N/A	7800000	N	N	ND
108-87-2	Methyl cyclohexane	ND	ND	µg/kg	--	0/24	1.2 - 1.8	N/A	650000 (5)	N	N	ND
1634-04-4	Methyl tert butyl ether (MTBE)	ND	ND	µg/kg	--	0/24	0.82 - 1.2	N/A	47000	C	N	ND
75-09-2	Methylene chloride	21 J	21 J	µg/kg	SS-172: 0.67-2.17 ft BGS (8/7/2018)	1/24	12 - 18	21	35000	N	N	BSV
100-42-5	Styrene	ND	ND	µg/kg	--	0/24	1.2 - 1.7	N/A	600000	N	N	ND
127-18-4	Tetrachloroethene	ND	ND	µg/kg	--	0/24	0.73 - 1.1	N/A	8100	N	N	ND
108-88-3	Toluene	1.3 J	1.3 J	µg/kg	SS-165: 0.17-0.67 ft BGS (8/6/2018)	1/24	0.77 - 1.2	1.3	490000	N	N	BSV

Table 2.47

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: EU Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Volatile Organic Compounds (cont.'d)											
156-60-5	trans-1,2-Dichloroethene	ND	ND	µg/kg	--	0/24	0.46 - 0.7	N/A	160000	N	N	ND
10061-02-6	trans-1,3-Dichloropropene	ND	ND	µg/kg	--	0/24	1 - 1.6	N/A	1800	C	N	ND
79-01-6	Trichloroethene	ND	ND	µg/kg	--	0/24	0.63 - 0.95	N/A	410	N	N	ND
75-69-4	Trichlorofluoromethane (CFC-11)	ND	ND	µg/kg	--	0/24	1.1 - 1.6	N/A	2300000	N	N	ND
76-13-1	Trifluorotrichloroethane (CFC-113)	ND	ND	µg/kg	--	0/24	1.3 - 1.9	N/A	670000	N	N	ND
75-01-4	Vinyl chloride	ND	ND	µg/kg	--	0/24	0.84 - 1.3	N/A	59	C	N	ND
1330-20-7	Xylenes (total)	ND	ND	µg/kg	--	0/24	1.6 - 2.4	N/A	58000	N	N	ND
	Semi-Volatiles Organic Compounds											
108-60-1	2,2'-Oxybis(1-chloropropane) (bis(2-Chloroisopropyl) ether)	ND	ND	µg/kg	--	0/42	11 - 50	N/A	310000	N	N	ND
95-95-4	2,4,5-Trichlorophenol	ND	ND	µg/kg	--	0/42	74 - 340	N/A	630000	N	N	ND
88-06-2	2,4,6-Trichlorophenol	ND	ND	µg/kg	--	0/42	69 - 320	N/A	6300	N	N	ND
120-83-2	2,4-Dichlorophenol	ND	ND	µg/kg	--	0/42	47 - 220	N/A	19000	N	N	ND
105-67-9	2,4-Dimethylphenol	ND	ND	µg/kg	--	0/42	43 - 200	N/A	130000	N	N	ND
51-28-5	2,4-Dinitrophenol	ND	ND	µg/kg	--	0/41	150 - 710	N/A	13000	N	N	ND
121-14-2	2,4-Dinitrotoluene	ND	ND	µg/kg	--	0/42	67 - 310	N/A	1700	C	N	ND
606-20-2	2,6-Dinitrotoluene	ND	ND	µg/kg	--	0/42	60 - 280	N/A	360	C	N	ND
91-58-7	2-Chloronaphthalene	ND	ND	µg/kg	--	0/42	15 - 70	N/A	480000	N	N	ND
95-57-8	2-Chlorophenol	ND	ND	µg/kg	--	0/42	11 - 50	N/A	39000	N	N	ND
91-57-6	2-Methylnaphthalene	5.7 J	110	µg/kg	SS-164: 0.17-0.67 ft BGS (8/6/2018)	41/42	0.54	110	240000	N	N	BSV
95-48-7	2-Methylphenol	ND	ND	µg/kg	--	0/42	33 - 150	N/A	320000	N	N	ND
88-74-4	2-Nitroaniline	ND	ND	µg/kg	--	0/42	43 - 200	N/A	63000	N	N	ND
88-75-5	2-Nitrophenol	ND	ND	µg/kg	--	0/42	14 - 65	N/A	--		N	ND
3/4-Cresol	3&4-Methylphenol	ND	ND	µg/kg	--	0/42	31 - 140	N/A	320000 (5)	N	N	ND
91-94-1	3,3'-Dichlorobenzidine	ND	ND	µg/kg	--	0/42	46 - 210	N/A	1200	C	N	ND
99-09-2	3-Nitroaniline	ND	ND	µg/kg	--	0/42	53 - 240	N/A	--		N	ND
534-52-1	4,6-Dinitro-2-methylphenol	ND	ND	µg/kg	--	0/41	86 - 400	N/A	510	N	N	ND
101-55-3	4-Bromophenyl phenyl ether	ND	ND	µg/kg	--	0/42	15 - 70	N/A	--		N	ND
59-50-7	4-Chloro-3-methylphenol	ND	ND	µg/kg	--	0/42	48 - 220	N/A	630000	N	N	ND
106-47-8	4-Chloroaniline	ND	ND	µg/kg	--	0/42	32 - 150	N/A	2700	C	N	ND
7005-72-3	4-Chlorophenyl phenyl ether	ND	ND	µg/kg	--	0/42	15 - 70	N/A	--		N	ND
100-01-6	4-Nitroaniline	ND	ND	µg/kg	--	0/42	65 - 300	N/A	25000	N	N	ND
100-02-7	4-Nitrophenol	ND	ND	µg/kg	--	0/42	100 - 470	N/A	--		N	ND
83-32-9	Acenaphthene	4.5 J	150	µg/kg	SS-173: 0.17-0.67 ft BGS (8/8/2018)	38/42	0.82 - 3.9	150	360000	N	N	BSV
208-96-8	Acenaphthylene	5.5 J	80	µg/kg	SS-171: 0.67-2.17 ft BGS (8/7/2018)	41/42	18	80	360000 (5)	N	N	BSV
98-86-2	Acetophenone	ND	ND	µg/kg	--	0/42	12 - 55	N/A	780000	N	N	ND
120-12-7	Anthracene	6.6 J	1500	µg/kg	SS-171: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	1500	1800000	N	N	BSV
1912-24-9	Atrazine	ND	ND	µg/kg	--	0/42	39 - 180	N/A	2400	C	N	ND
100-52-7	Benzaldehyde	32 J	49 J	µg/kg	SS-166: 0.17-0.67 ft BGS (8/7/2018)	2/42	25 - 110	49	170000	N	N	BSV
56-55-3	**Benzo(a)anthracene**	**38**	**1900**	**µg/kg**	**SS-171: 0.67-2.17 ft BGS (8/7/2018)**	**42/42**	**--**	**1900**	**1100**	**C**	**Y**	**ASV**
50-32-8	**Benzo(a)pyrene**	**43**	**1600**	**µg/kg**	**SS-171: 0.67-2.17 ft BGS (8/7/2018)**	**42/42**	**--**	**1600**	**110**	**C**	**Y**	**ASV**

Table 2.47

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: EU Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Semi-Volatiles Organic Compounds (cont.'d)											
205-99-2	**Benzo(b)fluoranthene**	**50**	**2700**	**µg/kg**	**SS-171: 0.67-2.17 ft BGS (8/7/2018)**	**42/42**	**--**	**2700**	**1100**	**C**	**Y**	**ASV**
191-24-2	Benzo(g,h,i)perylene	20	810	µg/kg	SS-170: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	810	180000 (5)	N	N	BSV
207-08-9	Benzo(k)fluoranthene	23	1100	µg/kg	SS-171: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	1100	11000	C	N	BSV
92-52-4	Biphenyl (1,1-Biphenyl)	ND	ND	µg/kg	--	0/42	18 - 85	N/A	4700	N	N	ND
111-91-1	bis(2-Chloroethoxy)methane	ND	ND	µg/kg	--	0/42	13 - 60	N/A	19000	N	N	ND
111-44-4	bis(2-Chloroethyl)ether	ND	ND	µg/kg	--	0/42	13 - 60	N/A	230	C	N	ND
117-81-7	bis(2-Ethylhexyl)phthalate (DEHP)	68 J	4500	µg/kg	SS-180: 0.5-2 ft BGS (11/14/2019)	22/42	55 - 250	4500	39000	C	N	BSV
85-68-7	Butyl benzylphthalate (BBP)	28 J	110 J	µg/kg	SS-175: 0.17-0.67 ft BGS (8/8/2018)	4/42	24 - 100	110	290000	C	N	BSV
105-60-2	Caprolactam	ND	ND	µg/kg	--	0/42	81 - 370	N/A	3100000	N	N	ND
86-74-8	**Carbazole**	**32 J**	**280**	**µg/kg**	**SS-171: 0.67-2.17 ft BGS (8/7/2018)**	**34/42**	**20 - 95**	**280**	**--**		**Y**	**AD**
218-01-9	Chrysene	40	1900	µg/kg	SS-171: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	1900	110000	C	N	BSV
53-70-3	**Dibenz(a,h)anthracene**	**13 J**	**190**	**µg/kg**	**SS-170: 0.67-2.17 ft BGS (8/7/2018)**	**33/42**	**0.71 - 3.3**	**190**	**110**	**C**	**Y**	**ASV**
132-64-9	Dibenzofuran	15 J	100 J	µg/kg	SS-173: 0.17-0.67 ft BGS (8/8/2018)	24/42	14 - 65	100	7300	N	N	BSV
84-66-2	Diethyl phthalate	ND	ND	µg/kg	--	0/42	33 - 150	N/A	5100000	N	N	ND
131-11-3	Dimethyl phthalate	22 J	1600	µg/kg	SS-182: 0-0.5 ft BGS (11/14/2019)	2/42	15 - 70	1600	5100000 (5)	N	N	BSV
84-74-2	Di-n-butylphthalate (DBP)	26 J	59 J	µg/kg	SS-164: 0.67-2.17 ft BGS (8/6/2018)	13/42	24 - 110	59	630000	N	N	BSV
117-84-0	Di-n-octyl phthalate (DnOP)	ND	ND	µg/kg	--	0/42	30 - 140	N/A	63000	N	N	ND
206-44-0	Fluoranthene	54	4600	µg/kg	SS-171: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	4600	240000	N	N	BSV
86-73-7	Fluorene	4.7 J	260	µg/kg	SS-171: 0.67-2.17 ft BGS (8/7/2018)	40/42	0.57 - 0.74	260	240000	N	N	BSV
118-74-1	Hexachlorobenzene	ND	ND	µg/kg	--	0/42	2.3 - 13	N/A	210	C	N	ND
87-68-3	Hexachlorobutadiene	ND	ND	µg/kg	--	0/42	13 - 60	N/A	1200	C	N	ND
77-47-4	Hexachlorocyclopentadiene	ND	ND	µg/kg	--	0/38	67 - 310	N/A	180	N	N	ND
67-72-1	Hexachloroethane	ND	ND	µg/kg	--	0/42	9.7 - 45	N/A	1800	C	N	ND
193-39-5	Indeno(1,2,3-cd)pyrene	17	690	µg/kg	SS-170: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	690	1100	C	N	BSV
78-59-1	Isophorone	ND	ND	µg/kg	--	0/42	13 - 60	N/A	570000	C	N	ND
91-20-3	Naphthalene	5.0 J	99	µg/kg	SS-170: 0.67-2.17 ft BGS (8/7/2018)	40/42	8.6 - 37	99	3800	C	N	BSV
98-95-3	Nitrobenzene	ND	ND	µg/kg	--	0/42	14 - 65	N/A	5100	C	N	ND
621-64-7	N-Nitrosodi-n-propylamine	ND	ND	µg/kg	--	0/42	12 - 55	N/A	78	C	N	ND
86-30-6	N-Nitrosodiphenylamine	ND	ND	µg/kg	--	0/42	13 - 60	N/A	110000	C	N	ND
87-86-5	Pentachlorophenol	ND	ND	µg/kg	--	0/41	62 - 290	N/A	1000	C	N	ND
85-01-8	Phenanthrene	18	2500	µg/kg	SS-171: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	2500	180000 (5)	N	N	BSV
108-95-2	Phenol	15 J	36 J	µg/kg	SS-182: 0-0.5 ft BGS (11/14/2019)	2/42	8.6 - 40	36	1900000	N	N	BSV
129-00-0	Pyrene	68	3900	µg/kg	SS-171: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	3900	180000	N	N	BSV
	Metals											
7429-90-5	**Aluminum**	**2100**	**14000**	**mg/kg**	**SS-168: 0.67-2.17 ft BGS (8/7/2018)**	**42/42**	**--**	**14000**	**7700**	**N**	**Y**	**ASV**
7440-36-0	Antimony	0.13 J	1.3 J	mg/kg	SS-166: 0.17-0.67 ft BGS (8/7/2018)	36/42	0.11 - 0.15	1.3	3.1	N	N	BSV
7440-38-2	**Arsenic**	**2.1**	**12**	**mg/kg**	**SS-168: 0.67-2.17 ft BGS (8/7/2018)**	**42/42**	**--**	**12**	**0.68**	**C**	**Y**	**ASV**
7440-39-3	Barium	28	160	mg/kg	SS-168: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	160	1500	N	N	BSV
7440-41-7	Beryllium	0.13 J	0.83	mg/kg	SS-168: 0.67-2.17 ft BGS (8/7/2018)	41/42	0.24	0.83	16	N	N	BSV
7440-43-9	Cadmium	0.13 J	2.5	mg/kg	SS-169: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	2.5	7.1	N	N	BSV

Table 2.47

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: EU Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Metals (cont.'d)											
7440-70-2	Calcium	42000	100000	mg/kg	SS-165: 0.67-2.17 ft BGS (8/6/2018)	42/42	--	100000	--		N	NAT
16065-83-1	Chromium III (trivalent)	4.9	53	mg/kg	SS-169: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	53	12000	N	N	BSV
18540-29-9	**Chromium VI (hexavalent)**	**0.36 J**	**0.81 J**	**mg/kg**	**SS-183: 0-0.5 ft BGS (11/14/2019)**	**8/42**	**0.26 - 3.4**	**0.81**	**0.3**	**C**	**Y**	**ASV**
7440-48-4	**Cobalt**	**1.6**	**9.7**	**mg/kg**	**SS-168: 0.67-2.17 ft BGS (8/7/2018)**	**42/42**	**--**	**9.7**	**2.3**	**N**	**Y**	**ASV**
7440-50-8	Copper	6.3	60	mg/kg	SS-169: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	60	310	N	N	BSV
57-12-5	Cyanide (total)	0.27 J	0.27 J	mg/kg	SS-166: 0.17-0.67 ft BGS (8/7/2018)	1/24	0.19 - 0.26	0.27	2.3	N	N	BSV
7439-89-6	**Iron**	**5700**	**25000**	**mg/kg**	**SS-168: 0.67-2.17 ft BGS (8/7/2018)**	**42/42**	**--**	**25000**	**5500**	**N**	**Y**	**ASV**
7439-92-1	Lead	6.9	92	mg/kg	SS-169: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	92	400	C	N	BSV
7439-95-4	Magnesium	18000	35000	mg/kg	SS-165: 0.67-2.17 ft BGS (8/6/2018)	42/42	--	35000	--		N	NAT
7439-96-5	**Manganese**	**150**	**690**	**mg/kg**	**SS-165: 0.67-2.17 ft BGS (8/6/2018)**	**42/42**	**--**	**690**	**180**	**N**	**Y**	**ASV**
7439-97-6	Mercury	0.022 J	0.25 J	mg/kg	SS-178: 0-0.5 ft BGS (11/14/2019)	41/42	0.028	0.25	1.1	N	N	BSV
7440-02-0	Nickel	4.9	32	mg/kg	SS-168: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	32	150	N	N	BSV
7440-09-7	Potassium	330	1900	mg/kg	SS-168: 0.17-0.67 ft BGS (8/7/2018)	42/42	--	1900	--		N	NAT
7782-49-2	Selenium	0.15 J	1.6	mg/kg	SS-168: 0.67-2.17 ft BGS (8/7/2018)	41/42	0.14	1.6	39	N	N	BSV
7440-22-4	Silver	0.025 J	1.3	mg/kg	SS-169: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	1.3	39	N	N	BSV
7440-23-5	Sodium	82 J	130 J	mg/kg	SS-165: 0.67-2.17 ft BGS (8/6/2018)	24/42	77 - 140	130	--		N	NAT
7440-28-0	**Thallium**	**0.075 J**	**0.49**	**mg/kg**	**SS-168: 0.67-2.17 ft BGS (8/7/2018)**	**42/42**	**--**	**0.49**	**0.078**	**N**	**Y**	**ASV**
7440-62-2	Vanadium	7.1	33	mg/kg	SS-168: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	33	39	N	N	BSV
7440-66-6	Zinc	20	180	mg/kg	SS-169: 0.67-2.17 ft BGS (8/7/2018)	42/42	--	180	2300	N	N	BSV
	Polychlorinated Biphenyls											
12674-11-2	Aroclor-1016 (PCB-1016)	ND	ND	µg/kg	--	0/42	23 - 270	N/A	410	N	N	ND
11104-28-2	Aroclor-1221 (PCB-1221)	ND	ND	µg/kg	--	0/42	25 - 300	N/A	200	C	N	ND
11141-16-5	Aroclor-1232 (PCB-1232)	ND	ND	µg/kg	--	0/42	24 - 290	N/A	170	C	N	ND
53469-21-9	Aroclor-1242 (PCB-1242)	48 J	61 J	µg/kg	SS-186: 0-0.5 ft BGS (11/14/2019)	2/42	20 - 240	61	230	C	N	BSV
12672-29-6	**Aroclor-1248 (PCB-1248)**	**50 J**	**4600**	**µg/kg**	**SS-169: 0.67-2.17 ft BGS (8/7/2018)**	**6/42**	**25 - 150**	**4600**	**230**	**C**	**Y**	**ASV**
11097-69-1	**Aroclor-1254 (PCB-1254)**	**30 J**	**860**	**µg/kg**	**SS-170: 0.67-2.17 ft BGS (8/7/2018)**	**30/42**	**24 - 290**	**860**	**120**	**C**	**Y**	**ASV**
11096-82-5	Aroclor-1260 (PCB-1260)	ND	ND	µg/kg	--	0/42	23 - 270	N/A	240	C	N	ND
	Pesticides											
72-54-8	4,4'-DDD	ND	ND	µg/kg	--	0/23	1.6 - 18	N/A	190	C	N	ND
72-55-9	4,4'-DDE	2.4 NJ	2.5 J	µg/kg	SS-171: 0.17-0.67 ft BGS (8/7/2018)	2/23	1.6 - 19	2.5	2000	C	N	BSV
50-29-3	4,4'-DDT	17 J	17 J	µg/kg	SS-173: 0.17-0.67 ft BGS (8/8/2018)	1/23	1.2 - 14	17	1900	C	N	BSV
309-00-2	Aldrin	ND	ND	µg/kg	--	0/24	0.81 - 9.6	N/A	39	C	N	ND
319-84-6	alpha-BHC	ND	ND	µg/kg	--	0/24	0.96 - 11	N/A	86	C	N	ND
5103-71-9	alpha-Chlordane	2.5 J	11 J	µg/kg	SS-173: 0.67-2.17 ft BGS (8/8/2018)	2/24	1.6 - 19	11	1700	C	N	BSV
319-85-7	beta-BHC	ND	ND	µg/kg	--	0/24	1.8 - 22	N/A	300	C	N	ND
319-86-8	delta-BHC	ND	ND	µg/kg	--	0/24	1.8 - 21	N/A	300	C	N	ND
60-57-1	Dieldrin	ND	ND	µg/kg	--	0/24	1.2 - 14	N/A	34	C	N	ND
959-98-8	Endosulfan I	ND	ND	µg/kg	--	0/23	1.3 - 15	N/A	47000	N	N	ND
33213-65-9	Endosulfan II	ND	ND	µg/kg	--	0/23	1.6 - 18	N/A	47000	N	N	ND
1031-07-8	Endosulfan sulfate	2.9 J	2.9 J	µg/kg	SS-168: 0.67-2.17 ft BGS (8/7/2018)	1/23	1.4 - 16	2.9	38000	N	N	BSV

Table 2.47

Occurrence, Distribution, and Identification of Chemicals of Potential Concern (COPCs) in EU Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: EU Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

CAS Number	Chemical	Minimum Concentration (1, 2)	Maximum Concentration (1, 2)	Units	Location of Maximum Concentration	Detection Frequency (2)	Range of Detection Limits (2)	Concentration Used for Screening (2)	Screening Toxicity Value (N/C) (3)		COPC Flag (Y/N)	Rationale for Selection or Deletion (4)
	Pesticides (cont.'d)											
72-20-8	Endrin	ND	ND	µg/kg	--	0/23	2 - 24	N/A	1900	N	N	ND
7421-93-4	Endrin aldehyde	2.0 NJ	8.9 J	µg/kg	SS-164: 0.17-0.67 ft BGS (8/6/2018)	2/23	1.4 - 16	8.9	1900	N	N	BSV
53494-70-5	Endrin ketone	ND	ND	µg/kg	--	0/24	0.94 - 11	N/A	1900	N	N	ND
58-89-9	gamma-BHC (lindane)	29 J	29 J	µg/kg	SS-169: 0.67-2.17 ft BGS (8/7/2018)	1/23	1.9 - 11	29	570	C	N	BSV
5103-74-2	gamma-Chlordane	1.5 NJ	1.5 NJ	µg/kg	SS-173: 0.17-0.67 ft BGS (8/8/2018)	1/23	1.3 - 15	1.5	1700	C	N	BSV
76-44-8	Heptachlor	ND	ND	µg/kg	--	0/24	1.7 - 20	N/A	130	C	N	ND
1024-57-3	Heptachlor epoxide	2.8 NJ	2.8 NJ	µg/kg	SS-168: 0.67-2.17 ft BGS (8/7/2018)	1/24	1.5 - 18	2.8	70	C	N	BSV
72-43-5	Methoxychlor	ND	ND	µg/kg	--	0/23	6.9 - 82	N/A	32000	N	N	ND
8001-35-2	Toxaphene	51 J	51 J	µg/kg	SS-172: 0.17-0.67 ft BGS (8/7/2018)	1/24	26 - 310	51	490	C	N	BSV
	Herbicides											
93-76-5	2,4,5-T	ND	ND	µg/kg	--	0/24	14 - 18	N/A	63000	N	N	ND
93-72-1	2,4,5-TP (Silvex)	73 J	73 J	µg/kg	SS-169: 0.67-2.17 ft BGS (8/7/2018)	1/24	15 - 20	73	51000	N	N	BSV
94-75-7	2,4-Dichlorophenoxyacetic acid (2,4-D)	ND	ND	µg/kg	--	0/24	52 - 69	N/A	70000	N	N	ND

Notes:

(1) Minimum/maximum detected concentration.

(2) Based on data collected from sampling locations: SS-164, SS-165, SS-166, SS-167, SS-168, SS-169, SS-170, SS-171, SS-172, SS-173, SS-174, SS-175, SS-178, SS-179, SS-180, SS-181, SS-182, SS-183, SS-184, SS-185, SS-186.

(3) Regional Screening Level (RSL) Summary Table (TR = 1E-06, HI = 0.1) , Residential Soil, November 2019.

(4) Rationale Codes

Selection Reason: Maximum detected above Screening Value (ASV)
Analyte Detected and no Screening Value available (AD)
Deletion Reason: Maximum detected below Screening Value (BSV)
Analyte Not Detected (ND)
Naturally Occurring (NAT)

(5) No screening value available, surrogate screening value implemented as follows:

Chemical		Surrogate
1,3-dichlorobenzene	-	1,2-dichlorobenzene
methyl cyclohexane	-	cyclohexane
3&4-methylphenol	-	3-methylphenol
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene
dimethylphthalate	-	diethylphthalate

Defintions:

-- = Not Available
N = Noncarcinogen
C = Carcinogen
Y = Yes
N = No
J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.

Table 3.1

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU01 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	1.0E+03	(c)	3.4E+03		µg/kg	2.4E+03	95% Adjusted Gamma UCL	(4)
Benzo(a)pyrene	µg/kg	1.0E+03	(c)	3.1E+03		µg/kg	2.3E+03	95% Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	1.4E+03	(c)	3.9E+03		µg/kg	2.9E+03	95% Adjusted Gamma UCL	(4)
Carbazole	µg/kg	1.0E+02	(c)	3.3E+02		µg/kg	2.3E+02	95% KM Adjusted Gamma UCL	(4)
Dibenz(a,h)anthracene	µg/kg	1.8E+02	(c)	5.7E+02		µg/kg	5.7E+02	95% KM Bootstrap t UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	6.4E+02	(c)	1.9E+03		µg/kg	1.5E+03	95% Adjusted Gamma UCL	(4)
Metals									
Aluminum	mg/kg	5.6E+03	(d)	8.4E+03	J	mg/kg	6.7E+03	95% Student's-t UCL	(4)
Arsenic	mg/kg	8.6E+00	(c)	2.9E+01		mg/kg	1.4E+01	95% Adjusted Gamma UCL	(4)
Chromium VI (hexavalent)	mg/kg	6.3E-01	(d)	2.3E+00		mg/kg	1.1E+00	95% KM (t) UCL	(4)
Cobalt	mg/kg	5.2E+00	(d)	9.6E+00		mg/kg	6.3E+00	95% Student's-t UCL	(4)
Iron	mg/kg	1.2E+04	(d)	1.6E+04		mg/kg	1.4E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	3.9E+02	(d)	6.2E+02	J	mg/kg	4.7E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	2.3E-01	(a)	8.2E-01		mg/kg	5.0E-01	95% KM Chebyshev UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	4.3E+01	(a)	1.8E+02		µg/kg	1.4E+02	95% KM Chebyshev UCL	(4)

Table 3.1

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU01 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(5)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(5)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM Bootstrap t UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Bootstrap method
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.2

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU02 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Metals									
Aluminum	mg/kg	1.4E+04	(d)	1.7E+04		mg/kg	1.6E+04	95% Student's-t UCL	(4)
Arsenic	mg/kg	1.1E+01	(d)	1.4E+01		mg/kg	1.3E+01	95% Student's-t UCL	(4)
Cobalt	mg/kg	8.0E+00	(d)	8.4E+00		mg/kg	8.4E+00	95% Student's-t UCL	(4)
Iron	mg/kg	2.3E+04	(d)	2.6E+04		mg/kg	2.5E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	6.5E+02	(d)	7.3E+02		mg/kg	7.1E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	2.3E-01	(d)	2.6E-01		mg/kg	2.5E-01	95% Student's-t UCL	(4)
Vanadium	mg/kg	3.6E+01	(d)	4.3E+01		mg/kg	4.0E+01	95% Modified-t UCL	(4)
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(5)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(5)

Notes:

(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% Modified-t UCL = UCL of the mean based upon the modified student's-t statistic
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.3

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	4.4E+04	(b)	2.6E+05		µg/kg	4.7E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Benzo(a)pyrene	µg/kg	4.6E+04	(b)	2.7E+05		µg/kg	4.9E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Benzo(b)fluoranthene	µg/kg	5.6E+04	(b)	3.3E+05		µg/kg	6.0E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Benzo(k)fluoranthene	µg/kg	2.2E+04	(b)	1.3E+05		µg/kg	2.4E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Carbazole	µg/kg	1.5E+04	(a)	9.2E+04		µg/kg	2.1E+05	99% KM Chebyshev UCL	(4)
Chrysene	µg/kg	4.2E+04	(b)	2.5E+05		µg/kg	4.6E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	6.6E+03	(c)	3.9E+04		µg/kg	1.4E+05	95% KM Adjusted Gamma UCL	(4)
Dibenzofuran	µg/kg	5.0E+03	(a)	3.0E+04		µg/kg	6.9E+04	99% KM Chebyshev UCL	(4)
Flouroanthene	µg/kg	9.9E+04	(b)	5.9E+05		µg/kg	1.1E+06	99% Chebyshev (Mean, Sd) UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	2.0E+04	(b)	1.2E+05		µg/kg	2.2E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Naphthalene	µg/kg	3.0E+03	(c)	1.8E+04		µg/kg	6.6E+04	95% KM Adjusted Gamma UCL	(4)
Phenanthrene	µg/kg	8.0E+04	(b)	4.8E+05		µg/kg	8.8E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Pyrene	µg/kg	7.6E+04	(b)	4.5E+05		µg/kg	8.2E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Metals									
Aluminum	mg/kg	6.3E+03	(d)	9.8E+03		mg/kg	8.0E+03	95% Student's-t UCL	(4)
Arsenic	mg/kg	6.0E+00	(d)	9.4E+00		mg/kg	8.0E+00	95% Student's-t UCL	(4)
Chromium VI (hexavalent)	mg/kg	4.6E-01	(a)	8.5E-01	J	mg/kg	8.6E-01	95% KM H-UCL	(4)
Cobalt	mg/kg	4.6E+00	(d)	7.9E+00		mg/kg	6.4E+00	95% Student's-t UCL	(4)
Iron	mg/kg	2.1E+04	(a)	5.4E+04		mg/kg	5.1E+04	95% Chebyshev (Mean, Sd) UCL	(4)
Lead	mg/kg	1.9E+02	(b)	1.0E+03		mg/kg	1.8E+03	99% Chebyshev (Mean, Sd) UCL	(4)
Manganese	mg/kg	1.4E+03	(a)	6.0E+03		mg/kg	1.1E+04	99% Chebyshev (Mean, Sd) UCL	(4)

Table 3.3

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Metals (cont.'d)									
Thallium	mg/kg	1.5E-01	(d)	2.5E-01		mg/kg	2.2E-01	95% KM (t) UCL	(4)
Vanadium	mg/kg	4.3E+01	(d)	1.7E+02		mg/kg	1.5E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(5)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(5)

Notes:

J - Estimated concentration.

(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).

(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:

(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.

(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.

95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic

(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.

(5) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.

(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.4

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU03 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Surface and Subsurface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	1.9E+04	(b)	2.6E+05		µg/kg	2.0E+05	99% KM Chebyshev UCL	(4)
Benzo(a)pyrene	µg/kg	2.0E+04	(b)	2.7E+05		µg/kg	2.1E+05	99% KM Chebyshev UCL	(4)
Benzo(b)fluoranthene	µg/kg	2.4E+04	(b)	3.3E+05		µg/kg	2.6E+05	99% KM Chebyshev UCL	(4)
Benzo(k)fluoranthene	µg/kg	9.6E+03	(b)	1.3E+05		µg/kg	1.0E+05	99% KM Chebyshev UCL	(4)
Carbazole	µg/kg	6.7E+03	(c)	9.2E+04		µg/kg	6.8E+04	95% KM Adjusted Gamma UCL	(4)
Chrysene	µg/kg	1.9E+04	(b)	2.5E+05		µg/kg	2.0E+05	99% KM Chebyshev UCL	(4)
Dibenz(a,h)anthracene	µg/kg	2.9E+03	(b)	3.9E+04		µg/kg	3.1E+04	99% KM Chebyshev UCL	(4)
Dibenzofuran	µg/kg	2.3E+03	(c)	3.0E+04		µg/kg	2.2E+04	95% KM Adjusted Gamma UCL	(4)
Flouroanthene	µg/kg	4.4E+04	(b)	5.9E+05		µg/kg	4.6E+05	99% KM Chebyshev UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	8.9E+03	(b)	1.2E+05		µg/kg	9.4E+04	99% KM Chebyshev UCL	(4)
Naphthalene	µg/kg	1.4E+03	(b)	1.8E+04		µg/kg	1.4E+04	99% KM Chebyshev UCL	(4)
Phenanthrene	µg/kg	3.6E+04	(b)	4.8E+05		µg/kg	3.8E+05	99% KM Chebyshev UCL	(4)
Pyrene	µg/kg	3.3E+04	(b)	4.5E+05		µg/kg	3.5E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Metals									
Aluminum	mg/kg	6.0E+03	(d)	9.8E+03		mg/kg	7.2E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	6.8E-01	(a)	5.0E+00	J	mg/kg	2.3E+00	95% KM Chebyshev UCL	(4)
Arsenic	mg/kg	7.3E+00	(d)	1.8E+01		mg/kg	9.0E+00	95% Student's-t UCL	(4)
Cadmium	mg/kg	1.3E+00	(a)	1.5E+01		mg/kg	5.9E+00	95% KM Chebyshev UCL	(4)
Chromium VI (hexavalent)	mg/kg	5.3E-01	(d)	1.7E+00		mg/kg	7.4E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	4.5E+00	(d)	7.9E+00		mg/kg	5.3E+00	95% Student's-t UCL	(4)
Iron	mg/kg	1.6E+04	(b)	5.4E+04		mg/kg	2.9E+04	95% Chebyshev (Mean, Sd) UCL	(4)
Lead	mg/kg	1.3E+02	(b)	1.0E+03		mg/kg	8.9E+02	99% Chebyshev (Mean, Sd) UCL	(4)
Manganese	mg/kg	8.0E+02	(a)	6.0E+03		mg/kg	2.6E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	mg/kg	1.7E-01	(c)	5.4E-01		mg/kg	2.6E-01	95% KM Adjusted Gamma UCL	(4)
Vanadium	mg/kg	2.8E+01	(a)	1.7E+02		mg/kg	7.6E+01	95% Chebyshev (Mean, Sd) UCL	(4)

Table 3.4

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU03 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Surface and Subsurface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls (cont.'d)									
Aroclor-1242 (PCB-1242)	µg/kg	--	--	9.8E+02		µg/kg	9.8E+02	Maximum Detected	(5)
Aroclor-1254 (PCB-1254)	µg/kg	--	--	1.3E+03		µg/kg	1.3E+03	Maximum Detected	(5)
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.

(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).

(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:

(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.

(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.

95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student’s t-Distribution Critical Value
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
99% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality

(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.

(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface and subsurface soil exposure.

(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.5

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)pyrene	µg/kg	3.1E+02	(c)	1.1E+03		µg/kg	3.7E+03	95% Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	4.1E+02	(c)	1.3E+03		µg/kg	4.6E+03	95% Adjusted Gamma UCL	(4)
Carbazole	µg/kg	--	--	1.3E+02	J	µg/kg	1.3E+02	Maximum Detected	(5)
Dibenz(a,h)anthracene	µg/kg	5.4E+01	(d)	1.8E+02		µg/kg	1.3E+02	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	8.0E+03	(d)	1.5E+04	J	mg/kg	1.1E+04	95% Student's-t UCL	(4)
Antimony	mg/kg	2.3E+00	(b)	1.2E+01	J	mg/kg	2.2E+01	99% Chebyshev (Mean, Sd) UCL	(4)
Arsenic	mg/kg	1.9E+01	(b)	5.0E+01		mg/kg	7.5E+01	95% H-UCL	(4)
Chromium VI (hexavalent)	mg/kg	5.8E-01	(d)	1.3E+00		mg/kg	8.7E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	1.1E+01	(c)	2.7E+01		mg/kg	2.8E+01	95% Adjusted Gamma UCL	(4)
Iron	mg/kg	1.4E+04	(d)	1.8E+04		mg/kg	1.6E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	3.3E+02	(d)	4.1E+02		mg/kg	4.0E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	4.8E-01	(c)	1.3E+00		mg/kg	1.7E+00	95% Adjusted Gamma UCL	(4)
Vanadium	mg/kg	2.8E+01	(c)	6.1E+01		mg/kg	5.9E+01	95% Adjusted Gamma UCL	(4)

Table 3.5

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (7)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(6)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(6)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
99% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% H-UCL = UCL based using Land's H-statistic
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(6) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(7) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.6

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU04 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	2.5E+02	(c)	1.2E+03		µg/kg	7.3E+02	95% KM Adjusted Gamma UCL	(4)
Benzo(a)pyrene	µg/kg	2.4E+02	(c)	1.1E+03		µg/kg	6.8E+02	95% KM Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	3.1E+02	(c)	1.3E+03		µg/kg	8.5E+02	95% KM Adjusted Gamma UCL	(4)
Carbazole	µg/kg	5.6E+01	(d)	4.0E+02		µg/kg	1.1E+02	95% KM (t) UCL	(5)
Dibenz(a,h)anthracene	µg/kg	3.8E+01	(c)	1.8E+02		µg/kg	1.1E+02	95% KM Adjusted Gamma UCL	(4)
Metals									
Aluminum	mg/kg	6.7E+03	(d)	1.5E+04	J	mg/kg	8.2E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	1.2E+00	(b)	1.2E+01	J	mg/kg	4.9E+00	95% KM Chebyshev UCL	(4)
Arsenic	mg/kg	1.6E+01	(b)	5.6E+01		mg/kg	3.6E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Chromium VI (hexavalent)	mg/kg	7.9E-01	(d)	1.5E+00		mg/kg	9.9E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	7.8E+00	(c)	2.7E+01		mg/kg	1.3E+01	95% Adjusted Gamma UCL	(4)
Iron	mg/kg	1.2E+04	(a)	1.9E+04		mg/kg	1.4E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	2.9E+02	(d)	6.2E+02		mg/kg	3.6E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	4.3E-01	(c)	1.5E+00		mg/kg	8.1E-01	95% KM Adjusted Gamma UCL	(4)
Vanadium	mg/kg	2.6E+01	(b)	7.0E+01		mg/kg	4.6E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	4.7E+01	(d)	2.1E+02		µg/kg	7.3E+01	95% KM (t) UCL	(4)

Table 3.6

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU04 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% KM Bootstrap t UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Bootstrap method
95% Hall's Bootstrap UCL = UCL based upon using Hall's Bootstrap method
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface and subsurface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.7

Exposure Point Concentration (EPC) Summary for Chemicals of Concern in EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03-EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	2.2E+04	(b)	2.6E+05		µg/kg	2.4E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Benzo(a)pyrene	µg/kg	2.3E+04	(b)	2.7E+05		µg/kg	2.5E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Benzo(b)fluoranthene	µg/kg	2.8E+04	(b)	3.3E+05		µg/kg	3.0E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Benzo(k)fluoranthene	µg/kg	1.1E+04	(b)	1.3E+05		µg/kg	1.2E+05	99% KM Chebyshev UCL	(4)
Carbazole	µg/kg	7.7E+03	(d)	9.2E+04		µg/kg	2.4E+04	95% KM (t) UCL	(4)
Chrysene	µg/kg	2.1E+04	(b)	2.5E+05		µg/kg	2.3E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	3.3E+03	(b)	3.9E+04		µg/kg	3.7E+04	99% KM Chebyshev UCL	(4)
Dibenzofuran	µg/kg	2.5E+03	(b)	3.0E+04		µg/kg	2.9E+04	99% KM Chebyshev UCL	(4)
Flouroanthene	µg/kg	5.0E+04	(b)	5.9E+05		µg/kg	5.4E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	1.0E+04	(b)	1.2E+05		µg/kg	1.1E+05	99% KM Chebyshev UCL	(4)
Naphthalene	µg/kg	1.5E+03	(b)	1.8E+04		µg/kg	1.7E+04	99% KM Chebyshev UCL	(4)
Phenanthrene	µg/kg	4.0E+04	(b)	4.8E+05		µg/kg	4.4E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Pyrene	µg/kg	3.8E+04	(b)	4.5E+05		µg/kg	4.1E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Metals									
Aluminum	mg/kg	7.1E+03	(d)	1.5E+04	J	mg/kg	8.5E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	1.4E+00	(b)	1.2E+01	J	mg/kg	5.6E+00	95% KM Chebyshev UCL	(4)
Arsenic	mg/kg	1.3E+01	(b)	5.0E+01		mg/kg	3.0E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Chromium VI (hexavalent)	mg/kg	5.2E-01	(d)	1.3E+00		mg/kg	6.9E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	7.6E+00	(c)	2.7E+01		mg/kg	1.2E+01	95% Adjusted Gamma UCL	(4)
Iron	mg/kg	1.8E+04	(d)	5.4E+04		mg/kg	2.4E+04	95% Modified-t UCL	(4)
Lead	mg/kg	1.2E+02	(b)	1.0E+03		mg/kg	4.7E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Manganese	mg/kg	8.7E+02	(a)	6.0E+03		mg/kg	2.9E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	mg/kg	3.2E-01	(b)	1.3E+00		mg/kg	6.0E-01	95% KM H-UCL	(4)
Vanadium	mg/kg	3.6E+01	(b)	1.7E+02		mg/kg	9.1E+01	95% Chebyshev (Mean, Sd) UCL	(4)

Table 3.7

Exposure Point Concentration (EPC) Summary for Chemicals of Concern in EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03-EU04 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(5)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(5)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Modified-t UCL = 95% UCL of the mean based upon the modified student's-t statistic
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
99% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.8

Exposure Point Concentration (EPC) Summary for Chemicals of Concern in EU03-EU04 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03-EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	9.7E+03	(b)	2.6E+05		µg/kg	6.8E+04	97.5% KM Chebyshev UCL	(4)
Benzo(a)pyrene	µg/kg	1.0E+04	(b)	2.7E+05		µg/kg	7.0E+04	97.5% KM Chebyshev UCL	(4)
Benzo(b)fluoranthene	µg/kg	1.2E+04	(b)	3.3E+05		µg/kg	8.6E+04	97.5% KM Chebyshev UCL	(4)
Benzo(k)fluoranthene	µg/kg	4.9E+03	(a)	1.3E+05		µg/kg	3.4E+04	97.5% KM Chebyshev UCL	(4)
Carbazole	µg/kg	3.4E+03	(b)	9.2E+04		µg/kg	3.8E+04	99% KM Chebyshev UCL	(4)
Chrysene	µg/kg	9.4E+03	(b)	2.5E+05		µg/kg	6.5E+04	97.5% KM Chebyshev UCL	(4)
Dibenz(a,h)anthracene	µg/kg	1.5E+03	(b)	3.9E+04		µg/kg	1.0E+04	97.5% KM Chebyshev UCL	(4)
Dibenzofuran	µg/kg	1.2E+03	(b)	3.0E+04		µg/kg	8.2E+03	97.5% KM Chebyshev UCL	(4)
Flouroanthene	µg/kg	2.2E+04	(a)	5.9E+05		µg/kg	1.5E+05	97.5% KM Chebyshev UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	4.5E+03	(b)	1.2E+05		µg/kg	3.1E+04	97.5% KM Chebyshev UCL	(4)
Naphthalene	µg/kg	7.0E+02	(a)	1.8E+04		µg/kg	3.5E+03	95% KM Chebyshev UCL	(4)
Phenanthrene	µg/kg	1.8E+04	(b)	4.8E+05		µg/kg	1.3E+05	97.5% KM Chebyshev UCL	(4)
Pyrene	µg/kg	1.7E+04	(a)	4.5E+05		µg/kg	1.2E+05	97.5% KM Chebyshev UCL	(4)
Metals									
Aluminum	mg/kg	6.3E+03	(d)	1.5E+04	J	mg/kg	7.3E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	9.6E-01	(a)	1.2E+01	J	mg/kg	2.9E+00	95% KM Chebyshev UCL	(4)
Arsenic	mg/kg	1.2E+01	(a)	5.6E+01		mg/kg	2.2E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Cadmium	mg/kg	7.8E-01	(a)	1.5E+01		mg/kg	3.1E+00	95% KM Chebyshev UCL	(4)
Chromium VI (hexavalent)	mg/kg	6.5E-01	(d)	1.7E+00		mg/kg	8.0E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	6.1E+00	(c)	2.7E+01		mg/kg	7.9E+00	95% Adjusted Gamma UCL	(4)
Iron	mg/kg	1.4E+04	(a)	5.4E+04		mg/kg	2.1E+04	95% Chebyshev (Mean, Sd) UCL	(4)
Lead	mg/kg	8.0E+01	(b)	1.0E+03		mg/kg	2.5E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Manganese	mg/kg	5.4E+02	(a)	6.0E+03		mg/kg	1.4E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	mg/kg	2.9E-01	(b)	1.5E+00		mg/kg	4.1E-01	95% KM H-UCL	(4)
Vanadium	mg/kg	2.7E+01	(a)	1.7E+02		mg/kg	5.2E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1242 (PCB-1242)	µg/kg	--	--	9.8E+02		µg/kg	9.8E+02	Maximum Detected	(5)
Aroclor-1254 (PCB-1254)	µg/kg	8.2E+01	(c)	1.3E+03		µg/kg	2.8E+02	95% KM Adjusted Gamma UCL	(4)

Table 3.8

Exposure Point Concentration (EPC) Summary for Chemicals of Concern in EU03-EU04 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU03-EU04 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
97.5% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
99% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the subsurface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.9

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	3.8E+02	(c)	1.9E+03		µg/kg	9.6E+02	95% Adjusted Gamma UCL	(4)
Benzo(a)pyrene	µg/kg	3.9E+02	(c)	1.6E+03		µg/kg	9.7E+02	95% Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	5.6E+02	(c)	2.1E+03		µg/kg	1.4E+03	95% Adjusted Gamma UCL	(4)
Carbazole	µg/kg	6.2E+01	(c)	3.2E+02		µg/kg	1.7E+02	95% KM Adjusted Gamma UCL	(4)
Dibenz(a,h)anthracene	µg/kg	3.7E+01	(d)	2.0E+02		µg/kg	7.2E+01	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	5.6E+03	(d)	9.8E+03		mg/kg	6.97E+03	95% Student's-t UCL	(4)
Arsenic	mg/kg	1.6E+01	(a)	5.9E+01		mg/kg	3.7E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Chromium VI (hexavalent)	mg/kg	4.9E-01	(d)	1.5E+00		mg/kg	7.1E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	6.0E+00	(b)	1.2E+01		mg/kg	7.6E+00	95% H-UCL	(4)
Copper	mg/kg	1.0E+02	(a)	9.6E+02		mg/kg	4.4E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Iron	mg/kg	1.2E+04	(d)	1.8E+04		mg/kg	1.4E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	3.2E+02	(d)	9.5E+02	J	mg/kg	4.6E+02	95% Student's-t UCL	(4)
Nickel	mg/kg	7.2E+01	(a)	7.0E+02		mg/kg	3.2E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	mg/kg	5.2E-01	(c)	2.7E+00		mg/kg	1.2E+00	95% Adjusted Gamma UCL	(4)
Vanadium	mg/kg	2.5E+01	(d)	4.5E+01		mg/kg	3.2E+01	95% Student's-t UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1248 (PCB-1248)	µg/kg	--	--	4.0E+02		µg/kg	4.0E+02	Maximum Detected	(5)
Aroclor-1254 (PCB-1254)	µg/kg	4.7E+01	(d)	1.6E+02		µg/kg	7.2E+01	95% KM (t) UCL	(4)

Table 3.9

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (7)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(6)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(6)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% H-UCL = UCL based using Land's H-statistic
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(6) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(7) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.10

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	3.2E+02	(c)	1.9E+03		µg/kg	6.3E+02	95% KM Adjusted Gamma UCL	(4)
Benzo(a)pyrene	µg/kg	3.3E+02	(c)	1.6E+03		µg/kg	6.2E+02	95% Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	4.7E+02	(c)	2.1E+03		µg/kg	8.6E+02	95% Adjusted Gamma UCL	(4)
Carbazole	µg/kg	6.0E+01	(c)	3.2E+02		µg/kg	1.1E+02	95% KM Adjusted Gamma UCL	(4)
Dibenz(a,h)anthracene	µg/kg	3.5E+01	(d)	2.0E+02		µg/kg	5.6E+01	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	6.3E+03	(d)	1.2E+04		mg/kg	7.4E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	6.3E-01	(b)	5.4E+00	J	mg/kg	8.1E-01	95% KM H-UCL	(4)
Arsenic	mg/kg	1.3E+01	(a)	5.9E+01		mg/kg	2.5E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Chromium VI (hexavalent)	mg/kg	8.1E-01	(b)	7.5E+00	J	mg/kg	1.0E+00	95% KM H-UCL	(4)
Cobalt	mg/kg	5.8E+00	(d)	1.2E+01		mg/kg	6.7E+00	95% Student's-t UCL	(4)
Copper	mg/kg	8.3E+01	(a)	9.6E+02		mg/kg	2.8E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Iron	mg/kg	1.3E+04	(d)	2.3E+04		mg/kg	1.5E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	3.8E+02	(d)	1.0E+03		mg/kg	4.8E+02	95% Student's-t UCL	(4)
Nickel	mg/kg	7.0E+01	(a)	7.0E+02		mg/kg	2.4E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	mg/kg	3.6E-01	(a)	2.7E+00		mg/kg	9.3E-01	95% KM Chebyshev UCL	(4)
Vanadium	mg/kg	2.4E+01	(d)	4.5E+01		mg/kg	2.8E+01	95% Student's-t UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1248 (PCB-1248)	µg/kg	4.5E+01	(a)	4.0E+02		µg/kg	1.5E+02	95% KM Chebyshev UCL	(4)
Aroclor-1254 (PCB-1254)	µg/kg	3.8E+01	(d)	1.6E+02		µg/kg	5.2E+01	95% KM (t) UCL	(4)

Table 3.10

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
South Dayton Dump Site
Moraine, Ohio

Medium: EU05-EU08 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (5)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.11

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatiles Organic Compounds									
1,1-Dichloroethane	µg/kg	--	--	4.3E+00	J	µg/kg	4.3E+00	Maximum Detected	(5)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	4.8E+03	(c)	2.7E+04		µg/kg	1.5E+05	95% KM Bootstrap t UCL	(4)
Benzo(a)pyrene	µg/kg	3.1E+03	(c)	1.7E+04		µg/kg	7.8E+04	95% KM Bootstrap t UCL	(4)
Benzo(b)fluoranthene	µg/kg	4.7E+03	(c)	2.5E+04		µg/kg	6.2E+04	95% Adjusted Gamma UCL	(4)
Carbazole	µg/kg	1.5E+03	(c)	8.4E+03		µg/kg	3.0E+04	95% KM Adjusted Gamma UCL	(4)
Dibenz(a,h)anthracene	µg/kg	5.2E+02	(c)	2.7E+03		µg/kg	1.1E+04	95% KM Bootstrap t UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	1.5E+03	(c)	7.6E+03		µg/kg	2.6E+04	95% KM Bootstrap t UCL	(4)
Metals									
Arsenic	mg/kg	9.2E+00	(d)	1.5E+01		mg/kg	1.3E+01	95% Student's-t UCL	(4)
Chromium VI (hexavalent)	mg/kg	5.6E-01	(a)	1.9E+00		mg/kg	2.1E+00	95% KM Chebyshev UCL	(4)
Cobalt	mg/kg	4.9E+00	(d)	6.8E+00		mg/kg	5.9E+00	95% Student's-t UCL	(4)
Copper	mg/kg	6.4E+02	(a)	3.7E+03		mg/kg	4.5E+03	97.5% Chebyshev (Mean, Sd) UCL	(4)
Iron	mg/kg	1.5E+04	(d)	2.4E+04		mg/kg	1.9E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	3.7E+02	(d)	5.6E+02		mg/kg	4.7E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	2.5E-01	(d)	5.3E-01		mg/kg	3.9E-01	95% Student's-t UCL	(4)
Vanadium	mg/kg	2.7E+01	(d)	6.0E+01		mg/kg	4.1E+01	95% Student's-t UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	5.7E+01	(a)	1.7E+02		µg/kg	2.1E+02	95% KM Chebyshev UCL	(4)

Table 3.11

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (7)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(6)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(6)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM Bootstrap t UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Bootstrap method
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(6) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(7) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.12

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU09 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatiles Organic Compounds									
1,1-Dichloroethane	µg/kg	--	--	4.3E+00	J	µg/kg	4.3E+00	Maximum Detected	(6)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	2.7E+03	(b)	2.7E+04		µg/kg	1.8E+04	97.5% KM Chebyshev UCL	(5)
Benzo(a)pyrene	µg/kg	1.8E+03	(b)	1.7E+04		µg/kg	1.1E+04	97.5% KM Chebyshev UCL	(5)
Benzo(b)fluoranthene	µg/kg	2.7E+03	(b)	2.5E+04		µg/kg	2.5E+04	99% Chebyshev (Mean, Sd) UCL	(4)
Carbazole	µg/kg	8.2E+02	(b)	8.4E+03		µg/kg	8.7E+03	99% KM Chebyshev UCL	(4)
Dibenz(a,h)anthracene	µg/kg	2.9E+02	(b)	2.7E+03		µg/kg	1.8E+03	97.5% KM Chebyshev UCL	(5)
Indeno(1,2,3-cd)pyrene	µg/kg	8.5E+02	(b)	7.6E+03		µg/kg	5.1E+03	97.5% KM Chebyshev UCL	(5)
Metals									
Aluminum	mg/kg	5.6E+03	(d)	9.3E+03		mg/kg	6.6E+03	95% Student's-t UCL	(4)
Arsenic	mg/kg	9.3E+00	(d)	1.6E+01		mg/kg	1.2E+01	95% Student's-t UCL	(4)
Chromium VI (hexavalent)	mg/kg	7.4E-01	(d)	1.9E+00		mg/kg	1.1E+00	95% KM (t) UCL	(4)
Cobalt	mg/kg	5.5E+00	(d)	9.8E+00		mg/kg	6.6E+00	95% Student's-t UCL	(4)
Copper	mg/kg	7.9E+02	(a)	4.7E+03		mg/kg	5.9E+03	99% Chebyshev (Mean, Sd) UCL	(4)
Cyanide (total)	mg/kg	8.5E-01	(d)	7.1E+00		mg/kg	2.3E+00	95% KM (t) UCL	(4)
Iron	mg/kg	1.7E+04	(c)	5.9E+04		mg/kg	2.7E+04	95% Adjusted Gamma UCL	(4)
Lead	mg/kg	1.5E+02	(d)	6.8E+02		mg/kg	2.6E+02	95% Student's-t UCL	(4)
Manganese	mg/kg	4.1E+02	(d)	8.1E+02		mg/kg	5.2E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	2.3E-01	(d)	5.3E-01		mg/kg	3.0E-01	95% Student's-t UCL	(4)
Vanadium	mg/kg	2.2E+01	(c)	6.0E+01		mg/kg	3.1E+01	95% Adjusted Gamma UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	3.8E+01	(d)	1.7E+02		µg/kg	7.0E+01	95% KM (t) UCL	(4)

Table 3.12

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU09 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU09 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (7)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
97.5% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
99% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Recommended UCL exceeds maximum observation, therefore the EPC is the lower suggested UCL.
(6) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface and subsurface soil exposure.
(7) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.13

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)pyrene	µg/kg	2.4E+02	(c)	8.4E+02		µg/kg	6.0E+02	95% Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	4.0E+02	(c)	1.3E+03		µg/kg	9.4E+02	95% Adjusted Gamma UCL	(4)
Carbazole	µg/kg	6.0E+01	(a)	2.8E+02		µg/kg	2.1E+02	95% KM Chebyshev UCL	(4)
Dibenz(a,h)anthracene	µg/kg	5.0E+01	(c)	1.5E+02		µg/kg	1.1E+02	95% Adjusted Gamma UCL	(4)
Metals									
Aluminum	mg/kg	6.6E+03	(d)	1.2E+04		mg/kg	9.1E+03	95% Student's-t UCL	(4)
Arsenic	mg/kg	1.0E+01	(c)	2.7E+01		mg/kg	1.8E+01	95% Adjusted Gamma UCL	(4)
Chromium VI (hexavalent)	mg/kg	3.0E-01	(d)	4.4E-01	J	mg/kg	3.7E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	5.6E+00	(d)	8.9E+00		mg/kg	7.1E+00	95% Student's-t UCL	(4)
Iron	mg/kg	1.4E+04	(d)	2.7E+04		mg/kg	1.8E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	3.4E+02	(d)	5.5E+02		mg/kg	4.2E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	2.1E-01	(d)	3.8E-01		mg/kg	2.8E-01	95% Student's-t UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	1.9E+02	(d)	7.6E+02	J	µg/kg	4.0E+02	95% KM (t) UCL	(4)
Pesticides									
Dieldrin	µg/kg	6.1E+00	(a)	3.7E+01	J	µg/kg	4.3E+01	97.5% KM Chebyshev UCL	(4)

Table 3.13

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(5)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(5)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
97.5% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.14

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)pyrene	µg/kg	2.4E+02	(c)	8.4E+02		µg/kg	4.5E+02	95% Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	3.9E+02	(c)	1.3E+03		µg/kg	7.0E+02	95% Adjusted Gamma UCL	(4)
Carbazole	µg/kg	5.0E+01	(a)	2.8E+02		µg/kg	1.5E+02	95% KM Chebyshev UCL	(4)
Dibenz(a,h)anthracene	µg/kg	5.8E+01	(c)	1.5E+02		µg/kg	1.6E+02	95% KM Adjusted Gamma UCL	(4)
Metals									
Aluminum	mg/kg	6.6E+03	(d)	1.2E+04		mg/kg	8.4E+03	95% Student's-t UCL	(4)
Arsenic	mg/kg	1.0E+01	(d)	2.7E+01		mg/kg	1.4E+01	95% Student's-t UCL	(4)
Chromium VI (hexavalent)	mg/kg	3.3E-01	(d)	8.8E-01	J	mg/kg	4.0E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	5.8E+00	(d)	8.9E+00		mg/kg	6.9E+00	95% Student's-t UCL	(4)
Cyanide (total)	mg/kg	7.8E-01	(a)	7.6E+00		mg/kg	4.8E+00	97.5% KM Chebyshev UCL	(4)
Iron	mg/kg	1.9E+04	(d)	4.7E+04		mg/kg	2.5E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	3.8E+02	(d)	8.9E+02	J	mg/kg	4.6E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	2.0E-01	(d)	3.8E-01		mg/kg	2.5E-01	95% Student's-t UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	1.3E+02	(d)	7.6E+02	J	µg/kg	2.7E+02	95% KM (t) UCL	(4)
Pesticides									
Dieldrin	µg/kg	4.3E+00	(a)	3.7E+01	J	µg/kg	3.0E+01	97.5% KM Chebyshev UCL	(4)

Table 3.14

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU10 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (5)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
97.5% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.15

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	3.4E+02	(d)	1.2E+03		µg/kg	6.0E+02	95% Student's-t UCL	(4)
Benzo(a)pyrene	µg/kg	3.6E+02	(c)	1.4E+03		µg/kg	1.4E+03	95% KM Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	5.1E+02	(c)	2.0E+03		µg/kg	1.9E+03	95% KM Adjusted Gamma UCL	(4)
Carbazole	µg/kg	5.3E+01	(d)	1.2E+02		µg/kg	7.6E+01	95% KM (t) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	5.8E+01	(c)	2.2E+02		µg/kg	2.1E+02	95% KM Adjusted Gamma UCL	(4)
Metals									
Aluminum	mg/kg	5.5E+03	(d)	1.1E+04		mg/kg	7.51E+03	95% Modified-t UCL	(4)
Arsenic	mg/kg	7.6E+00	(d)	1.3E+01		mg/kg	9.6E+00	95% Student's-t UCL	(4)
Chromium VI (hexavalent)	mg/kg	7.3E-01	(a)	3.6E+00		mg/kg	3.1E+00	95% KM Chebyshev UCL	(4)
Cobalt	mg/kg	4.7E+00	(d)	6.9E+00		mg/kg	5.6E+00	95% Student's-t UCL	(4)
Iron	mg/kg	1.5E+04	(d)	2.5E+04		mg/kg	1.9E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	3.9E+02	(d)	5.5E+02		mg/kg	4.5E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	1.5E-01	(d)	2.4E-01		mg/kg	1.8E-01	95% KM (t) UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	2.0E+02	(d)	9.1E+02		µg/kg	4.3E+02	95% KM (t) UCL	(4)

Table 3.15

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(5)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(5)

Notes:

(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Modified-t UCL = 95% UCL of the mean based upon the modified student's-t statistic
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.16

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU11 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
Trichloroethene	µg/kg	1.6E+02	(b)	2.4E+03		µg/kg	1.7E+03	99% KM Chebyshev UCL	(4)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	2.6E+02	(c)	1.2E+03		µg/kg	5.4E+02	95% Adjusted Gamma UCL	(4)
Benzo(a)pyrene	µg/kg	2.7E+02	(c)	1.4E+03		µg/kg	5.8E+02	95% KM Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	3.8E+02	(c)	2.0E+03		µg/kg	7.8E+02	95% Adjusted Gamma UCL	(4)
Carbazole	µg/kg	4.3E+01	(d)	1.2E+02		µg/kg	5.7E+01	95% KM (t) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	4.3E+01	(d)	2.2E+02		µg/kg	6.9E+01	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	6.2E+03	(c)	1.4E+04	J	mg/kg	8.1E+03	95% Adjusted Gamma UCL	(4)
Arsenic	mg/kg	1.0E+01	(b)	4.5E+01		mg/kg	2.1E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Cadmium	mg/kg	1.6E+00	(a)	1.9E+01		mg/kg	6.7E+00	95% KM Chebyshev UCL	(4)
Chromium VI (hexavalent)	mg/kg	1.0E+00	(c)	3.7E+00		mg/kg	1.9E+00	95% KM Adjusted Gamma UCL	(4)
Cobalt	mg/kg	5.9E+00	(c)	2.2E+01		mg/kg	7.9E+00	95% Adjusted Gamma UCL	(4)
Copper	mg/kg	7.9E+01	(c)	4.1E+02		mg/kg	1.5E+02	95% Adjusted Gamma UCL	(4)
Iron	mg/kg	1.7E+04	(c)	6.4E+04		mg/kg	2.4E+04	95% Adjusted Gamma UCL	(4)
Manganese	mg/kg	3.8E+02	(d)	7.3E+02	J	mg/kg	4.5E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	2.4E-01	(b)	1.4E+00		mg/kg	3.2E-01	95% KM H-UCL	(4)
Vanadium	mg/kg	2.1E+01	(b)	7.2E+01		mg/kg	3.8E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	1.1E+02	(d)	9.1E+02		µg/kg	2.2E+02	95% KM (t) UCL	(4)

Table 3.16

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU11 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU11 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Asbestos									
Chrysotile asbestos	%	--	--	2.0E+00		%	2.0E+00	Maximum Detected	(5)

Notes:

(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
99% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the subsurface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.17

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)pyrene	µg/kg	1.5E+02	(c)	7.5E+02		µg/kg	9.1E+02	95% KM Bootstrap t UCL	(4)
Carbazole	µg/kg	3.7E+01	(d)	1.4E+02	J	µg/kg	5.8E+01	95% KM (t) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	3.3E+01	(d)	1.3E+02		µg/kg	6.3E+01	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	3.6E+03	(d)	7.9E+03		mg/kg	5.2E+03	95% Student's-t UCL	(4)
Arsenic	mg/kg	8.3E+00	(c)	4.6E+01	J	mg/kg	1.9E+01	95% Adjusted Gamma UCL	(4)
Cobalt	mg/kg	4.4E+00	(d)	7.1E+00		mg/kg	5.7E+00	95% Student's-t UCL	(4)
Iron	mg/kg	8.4E+03	(d)	1.2E+04		mg/kg	1.0E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	2.2E+02	(d)	4.1E+02		mg/kg	3.3E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	1.7E-01	(d)	7.0E-01		mg/kg	2.7E-01	95% KM (t) UCL	(4)
Vanadium	mg/kg	1.5E+01	(d)	4.9E+01	J	mg/kg	2.0E+01	95% Student's-t UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	--	--	2.1E+02		µg/kg	2.1E+02	Maximum Detected	(5)

Table 3.17

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (7)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(6)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(6)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Bootstrap t UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Bootstrap method
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(6) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(7) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.18

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU12 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)pyrene	µg/kg	3.2E+01	(c)	7.7E+02		µg/kg	6.6E+02	95% KM Bootstrap t UCL	(4)
Carbazole	µg/kg	3.2E+01	(d)	1.4E+02	J	µg/kg	4.5E+01	95% KM (t) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	2.2E+01	(d)	1.3E+02		µg/kg	4.0E+01	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	4.3E+03	(d)	1.0E+04	J	mg/kg	5.6E+03	95% Student's-t UCL	(4)
Arsenic	mg/kg	1.5E+01	(c)	5.1E+01		mg/kg	2.7E+01	95% Adjusted Gamma UCL	(4)
Chromium VI (hexavalent)	mg/kg	6.2E-01	(d)	2.4E+00		mg/kg	1.0E+00	95% KM (t) UCL	(4)
Cobalt	mg/kg	4.7E+00	(d)	7.1E+00		mg/kg	5.6E+00	95% Student's-t UCL	(4)
Iron	mg/kg	1.1E+04	(c)	3.8E+04		mg/kg	1.7E+04	95% Adjusted Gamma UCL	(4)
Manganese	mg/kg	4.1E+02	(c)	2.6E+03		mg/kg	9.5E+02	95% Adjusted Gamma UCL	(4)
Thallium	mg/kg	2.5E-01	(d)	1.1E+00		mg/kg	3.9E-01	95% KM (t) UCL	(4)
Vanadium	mg/kg	2.1E+01	(d)	4.9E+01	J	mg/kg	2.7E+01	95% Student's-t UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	4.7E+01	(a)	2.1E+02		µg/kg	8.4E+01	95% KM (t) UCL	(5)

Table 3.18

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU12 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Bootstrap t UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Bootstrap method
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.19

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)pyrene	µg/kg	1.5E+02	(c)	7.5E+02		µg/kg	9.1E+02	95% KM Bootstrap t UCL	(4)
Carbazole	µg/kg	3.7E+01	(d)	1.4E+02	J	µg/kg	5.8E+01	95% KM (t) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	3.3E+01	(d)	1.3E+02		µg/kg	6.3E+01	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	3.6E+03	(d)	7.9E+03		mg/kg	5.2E+03	95% Student's-t UCL	(4)
Arsenic	mg/kg	8.3E+00	(c)	4.6E+01	J	mg/kg	1.9E+01	95% Adjusted Gamma UCL	(4)
Cobalt	mg/kg	4.4E+00	(d)	7.1E+00		mg/kg	5.7E+00	95% Student's-t UCL	(4)
Iron	mg/kg	8.4E+03	(d)	1.2E+04		mg/kg	1.0E+04	95% Student's-t UCL	(4)
Manganese	mg/kg	2.2E+02	(d)	4.1E+02		mg/kg	3.3E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	1.7E-01	(d)	7.0E-01		mg/kg	2.7E-01	95% KM (t) UCL	(4)
Vanadium	mg/kg	1.5E+01	(d)	4.9E+01	J	mg/kg	2.0E+01	95% Student's-t UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	--	--	2.1E+02		µg/kg	2.1E+02	Maximum Detected	(5)

Table 3.19

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU12 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (7)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(6)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(6)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Bootstrap t UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Bootstrap method
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(6) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(7) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.20

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU13 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/kg	--	--	2.5E+01	J	µg/kg	2.5E+01	Maximum Detected	(5)
Ethylbenzene	µg/kg	7.4E+03	(d)	5.9E+04		µg/kg	1.8E+04	95% KM (t) UCL	(4)
Trichloroethene	µg/kg	1.6E+03	(c)	1.3E+04	J	µg/kg	5.9E+03	95% Adjusted Gamma UCL	(4)
Xylenes (total)	µg/kg	1.4E+04	(c)	1.4E+05		µg/kg	7.1E+04	95% KM Adjusted Gamma UCL	(4)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	6.5E+02	(c)	5.2E+03		µg/kg	4.7E+03	95% KM Bootstrap t UCL	(4)
Benzo(a)pyrene	µg/kg	5.9E+02	(c)	5.2E+03		µg/kg	3.1E+03	95% KM Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	1.0E+03	(c)	8.0E+03		µg/kg	8.1E+03	95% KM Bootstrap t UCL	(4)
Carbazole	µg/kg	1.3E+02	(d)	1.1E+03		µg/kg	3.1E+02	95% KM (t) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	1.1E+02	(d)	9.2E+02		µg/kg	2.5E+02	95% KM (t) UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	3.6E+02	(c)	3.1E+03		µg/kg	3.2E+03	95% KM Bootstrap t UCL	(4)
Naphthalene	µg/kg	1.5E+03	(b)	1.1E+04		µg/kg	1.0E+04	99% KM Chebyshev UCL	(4)
Metals									
Aluminum	mg/kg	6.5E+03	(d)	1.4E+04		mg/kg	8.1E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	5.9E+01	(b)	1.4E+03	J	mg/kg	6.0E+02	99% KM Chebyshev UCL	(4)
Arsenic	mg/kg	2.7E+01	(c)	7.0E+01		mg/kg	4.8E+01	95% Adjusted Gamma UCL	(4)
Barium	mg/kg	5.3E+02	(d)	1.8E+03		mg/kg	8.0E+02	95% Student's-t UCL	(4)
Cadmium	mg/kg	4.3E+00	(b)	3.0E+01		mg/kg	2.8E+01	99% KM Chebyshev UCL	(4)
Chromium VI (hexavalent)	mg/kg	6.4E-01	(d)	2.6E+00		mg/kg	1.0E+00	95% KM (t) UCL	(4)
Cobalt	mg/kg	9.0E+00	(d)	2.4E+01		mg/kg	1.2E+01	95% Student's-t UCL	(4)
Copper	mg/kg	6.4E+02	(c)	3.3E+03		mg/kg	1.7E+03	95% Adjusted Gamma UCL	(4)
Cyanide (total)	mg/kg	1.0E+00	(d)	4.1E+00		mg/kg	1.7E+00	95% KM (t) UCL	(4)
Iron	mg/kg	3.5E+04	(c)	1.8E+05		mg/kg	6.8E+04	95% Adjusted Gamma UCL	(4)
Lead	mg/kg	1.6E+03	(c)	2.6E+04	J	mg/kg	5.5E+03	95% Adjusted Gamma UCL	(4)
Lead - coarse fraction	mg/kg	3.6E+03	--	6.3E+03		mg/kg	6.3E+03	Maximum Detected	(5)
Lead - fine fraction	mg/kg	3.4E+03	--	5.3E+03		mg/kg	5.3E+03	Maximum Detected	(5)
Lead - total (calculated by fine/coarse fraction)	mg/kg	5.7E+02	--	1.1E+03		mg/kg	1.1E+03	Maximum Detected	(5)
Manganese	mg/kg	5.0E+02	(c)	2.3E+03		mg/kg	9.8E+02	95% Adjusted Gamma UCL	(4)
Mercury	mg/kg	4.2E-01	(c)	3.2E+00		mg/kg	1.1E+00	95% Adjusted Gamma UCL	(4)
Nickel	mg/kg	5.6E+01	(b)	3.1E+02		mg/kg	1.6E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	mg/kg	5.1E-01	(b)	2.0E+00		mg/kg	1.1E+00	95% KM H-UCL	(4)
Vanadium	mg/kg	3.3E+01	(c)	1.3E+02		mg/kg	5.7E+01	95% Adjusted Gamma UCL	(4)
Zinc	mg/kg	7.6E+02		3.4E+03	J	mg/kg	1.9E+03	95% Adjusted Gamma UCL	(4)

Table 3.20

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU13 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU13 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls									
Aroclor-1242 (PCB-1242)	µg/kg	--	--	3.8E+02		µg/kg	3.8E+02	Maximum Detected	(5)
Aroclor-1254 (PCB-1254)	µg/kg	1.1E+04	(b)	1.4E+05		µg/kg	1.0E+05	99% KM Chebyshev UCL	(4)
Pesticides									
Heptachlor epoxide	µg/kg	--	--	7.5E+01	NJ	µg/kg	7.5E+01	Maximum Detected	(5)
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.
NJ - Tentatively identified compound, estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% KM Bootstrap t UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Bootstrap method
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic
99% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.21

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/kg	2.5E+01	(d)	1.1E+02	J	µg/kg	6.3E+01	95% KM (t) UCL	(4)
Trichloroethene	µg/kg	1.1E+03	(c)	6.4E+03		µg/kg	1.0E+04	95% Adjusted Gamma UCL	(4)
Vinyl chloride	µg/kg	6.6E+01	(d)	4.1E+02	J	µg/kg	1.9E+02	95% KM (t) UCL	(4)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	6.1E+02	(d)	1.7E+03		µg/kg	1.0E+03	95% Student's-t UCL	(4)
Benzo(a)pyrene	µg/kg	6.5E+02	(d)	2.0E+03		µg/kg	1.2E+03	95% Student's-t UCL	(4)
Benzo(b)fluoranthene	µg/kg	9.6E+02	(d)	3.0E+03		µg/kg	1.7E+03	95% Student's-t UCL	(4)
Carbazole	µg/kg	6.9E+01	(d)	1.2E+02		µg/kg	9.6E+01	95% KM (t) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	1.5E+02	(d)	5.1E+02		µg/kg	3.0E+02	95% KM (t) UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	5.2E+02	(d)	1.7E+03		µg/kg	9.5E+02	95% Student's-t UCL	(4)
Metals									
Aluminum	mg/kg	6.6E+03	(d)	9.2E+03		mg/kg	8.0E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	6.9E+00	(d)	1.3E+01		mg/kg	1.0E+01	95% Student's-t UCL	(4)
Arsenic	mg/kg	1.8E+01	(d)	3.3E+01		mg/kg	2.5E+01	95% Student's-t UCL	(4)
Barium	mg/kg	1.1E+03	(c)	3.1E+03		mg/kg	4.7E+03	95% Adjusted Gamma UCL	(4)
Cadmium	mg/kg	5.7E+00	(d)	1.1E+01		mg/kg	8.7E+00	95% Student's-t UCL	(4)
Chromium VI (hexavalent)	mg/kg	6.5E-01	(d)	1.2E+00		mg/kg	9.6E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	1.1E+01	(d)	1.7E+01		mg/kg	1.4E+01	95% Student's-t UCL	(4)
Copper	mg/kg	1.1E+03	(d)	2.4E+03		mg/kg	1.8E+03	95% Student's-t UCL	(4)
Cyanide (total)	mg/kg	2.5E+00	(d)	1.3E+01		mg/kg	6.2E+00	95% KM (t) UCL	(4)
Iron	mg/kg	4.8E+04	(d)	7.1E+04		mg/kg	6.4E+04	95% Student's-t UCL	(4)
Lead	mg/kg	1.5E+03	(d)	4.2E+03		mg/kg	2.7E+03	95% Student's-t UCL	(4)
Lead - coarse fraction	mg/kg	2.5E+04	--	4.7E+04		mg/kg	4.7E+04	Maximum Detected	(5)
Lead - fine fraction	mg/kg	1.6E+04	--	2.8E+04		mg/kg	2.8E+04	Maximum Detected	(5)
Lead - total (calculated by fine/coarse fraction)	mg/kg	2.3E+04	--	4.3E+04		mg/kg	4.3E+04	Maximum Detected	(5)
Manganese	mg/kg	5.0E+02	(d)	8.8E+02		mg/kg	6.9E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	2.5E-01	(d)	4.9E-01		mg/kg	3.4E-01	95% Student's-t UCL	(4)
Vanadium	mg/kg	2.7E+01	(d)	4.6E+01		mg/kg	3.5E+01	95% Student's-t UCL	(4)
Zinc	mg/kg	1.2E+03	(d)	3.0E+03		mg/kg	2.1E+03	95% Student's-t UCL	(4)

Table 3.21

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls									
Aroclor-1242 (PCB-1242)	µg/kg	--	--	3.7E+02		µg/kg	3.7E+02	Maximum Detected	(5)
Aroclor-1254 (PCB-1254)	µg/kg	2.4E+02	(d)	6.2E+02		µg/kg	4.2E+02	95% KM (t) UCL	(4)
Aroclor-1260 (PCB-1260)	µg/kg	2.1E+03	(a)	1.4E+04		µg/kg	1.3E+04	95% KM Chebyshev UCL	(4)
Dioxins/Furans (7)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(6)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(6)

Notes:
J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(6) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(7) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.22

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU14 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/kg	3.3E+01	(d)	2.4E+02	J	µg/kg	6.5E+01	95% KM (t) UCL	(4)
Ethylbenzene	µg/kg	1.7E+03	(d)	1.5E+04		µg/kg	3.7E+03	95% KM (t) UCL	(4)
Trichloroethene	µg/kg	6.2E+02	(c)	6.4E+03		µg/kg	3.0E+03	95% KM Adjusted Gamma UCL	(4)
Vinyl chloride	µg/kg	6.1E+01	(d)	4.1E+02	J	µg/kg	1.2E+02	95% KM (t) UCL	(4)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	3.5E+02	(c)	1.7E+03		µg/kg	9.4E+02	95% KM Adjusted Gamma UCL	(4)
Benzo(a)pyrene	µg/kg	3.7E+02	(c)	2.0E+03		µg/kg	1.1E+03	95% KM Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	5.5E+02	(c)	3.0E+03		µg/kg	1.6E+03	95% KM Adjusted Gamma UCL	(4)
Carbazole	µg/kg	5.7E+01	(d)	1.2E+02		µg/kg	7.9E+01	95% KM (t) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	8.7E+01	(d)	5.1E+02		µg/kg	1.7E+02	95% KM (t) UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	3.0E+02	(d)	1.7E+03		µg/kg	5.5E+02	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	6.1E+03	(d)	9.2E+03		mg/kg	7.3E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	4.9E+00	(a)	1.3E+01		mg/kg	1.0E+01	95% KM Chebyshev UCL	(4)
Arsenic	mg/kg	1.7E+01	(d)	3.5E+01		mg/kg	2.2E+01	95% Student's-t UCL	(4)
Barium	mg/kg	7.2E+02	(c)	3.1E+03		mg/kg	1.8E+03	95% Adjusted Gamma UCL	(4)
Cadmium	mg/kg	4.8E+00	(d)	1.3E+01		mg/kg	7.0E+00	95% Student's-t UCL	(4)
Chromium VI (hexavalent)	mg/kg	1.9E+00	(b)	8.6E+00		mg/kg	4.8E+00	95% KM Chebyshev UCL	(4)
Cobalt	mg/kg	9.3E+00	(d)	1.7E+01		mg/kg	1.2E+01	95% Student's-t UCL	(4)
Copper	mg/kg	6.6E+02	(c)	2.4E+03		mg/kg	1.7E+03	95% Adjusted Gamma UCL	(4)
Cyanide (total)	mg/kg	1.4E+00	(c)	1.3E+01		mg/kg	1.1E+01	95% KM Bootstrap t UCL	(4)
Iron	mg/kg	3.3E+04	(d)	7.1E+04		mg/kg	4.5E+04	95% Student's-t UCL	(4)
Lead	mg/kg	9.4E+02	(c)	4.2E+03		mg/kg	2.8E+03	95% Adjusted Gamma UCL	(4)
Lead - coarse fraction	mg/kg	2.5E+04	--	4.7E+04		mg/kg	4.7E+04	Maximum Detected	(5)
Lead - fine fraction	mg/kg	1.6E+04	--	2.8E+04		mg/kg	2.8E+04	Maximum Detected	(5)
Lead - total (calculated by fine/coarse fraction)	mg/kg	2.3E+04	--	4.3E+04		mg/kg	4.3E+04	Maximum Detected	(5)
Manganese	mg/kg	3.7E+02	(c)	8.8E+02		mg/kg	5.4E+02	95% Adjusted Gamma UCL	(4)
Thallium	mg/kg	3.0E-01	(c)	9.8E-01		mg/kg	5.2E-01	95% KM Adjusted Gamma UCL	(4)
Vanadium	mg/kg	2.6E+01	(d)	4.6E+01		mg/kg	3.2E+01	95% Student's-t UCL	(4)
Zinc	mg/kg	9.3E+02	(c)	3.0E+03		mg/kg	2.3E+03	95% Adjusted Gamma UCL	(4)

Table 3.22

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU14 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU14 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls									
Aroclor-1242 (PCB-1242)	µg/kg	--	--	3.7E+02		µg/kg	3.7E+02	Maximum Detected	(5)
Aroclor-1248 (PCB-1248)	µg/kg	--	--	4.3E+02		µg/kg	4.3E+02	Maximum Detected	(5)
Aroclor-1254 (PCB-1254)	µg/kg	4.3E+02	(c)	3.7E+03		µg/kg	2.6E+03	95% KM Bootstrap t UCL	(4)
Aroclor-1260 (PCB-1260)	µg/kg	1.2E+03	(d)	1.4E+04		µg/kg	3.4E+03	95% KM (t) UCL	(4)
Pesticides									
Dieldrin	µg/kg	2.3E+01	(a)	2.7E+02	J	µg/kg	1.5E+02	95% KM Chebyshev UCL	(4)
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM Bootstrap t UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Bootstrap method
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.23

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/kg	--	--	5.3E+00	J	µg/kg	5.3E+00	Maximum Detected	(6)
Trichloroethene	µg/kg	1.1E+03	(c)	4.3E+03		µg/kg	3.4E+03	95% KM Adjusted Gamma UCL	(4)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	8.6E+02	(b)	9.6E+03		µg/kg	5.2E+03	97.5% KM Chebyshev UCL	(5)
Benzo(a)pyrene	µg/kg	8.0E+02	(b)	8.5E+03		µg/kg	4.7E+03	97.5% KM Chebyshev UCL	(5)
Benzo(b)fluoranthene	µg/kg	1.1E+03	(b)	1.2E+04		µg/kg	6.6E+03	97.5% KM Chebyshev UCL	(4)
Carbazole	µg/kg	1.3E+02	(a)	1.5E+03		µg/kg	8.1E+02	97.5% KM Chebyshev UCL	(4)
Dibenz(a,h)anthracene	µg/kg	1.6E+02	(c)	1.6E+03		µg/kg	1.2E+03	95% KM Adjusted Gamma UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	5.4E+02	(c)	5.3E+03		µg/kg	4.0E+03	95% KM Adjusted Gamma UCL	(4)
Metals									
Aluminum	mg/kg	7.0E+03	(d)	1.3E+04		mg/kg	8.7E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	3.5E+00	(d)	1.2E+01		mg/kg	5.6E+00	95% Student's-t UCL	(4)
Arsenic	mg/kg	1.4E+01	(d)	2.7E+01		mg/kg	1.8E+01	95% Student's-t UCL	(4)
Barium	mg/kg	7.1E+02	(d)	2.9E+03		mg/kg	1.2E+03	95% Student's-t UCL	(4)
Cadmium	mg/kg	3.5E+00	(c)	1.6E+01		mg/kg	9.2E+00	95% Adjusted Gamma UCL	(4)
Chromium VI (hexavalent)	mg/kg	1.3E+00	(a)	6.9E+00		mg/kg	3.7E+00	95% KM Chebyshev UCL	(4)
Cobalt	mg/kg	1.1E+01	(c)	2.9E+01		mg/kg	1.9E+01	95% Adjusted Gamma UCL	(4)
Copper	mg/kg	5.8E+02	(c)	2.9E+03		mg/kg	1.9E+03	95% Adjusted Gamma UCL	(4)
Cyanide (total)	mg/kg	5.0E+00	(d)	4.1E+01		mg/kg	1.4E+01	95% KM (t) UCL	(4)
Iron	mg/kg	3.7E+04	(c)	1.1E+05		mg/kg	7.3E+04	95% Adjusted Gamma UCL	(4)
Lead	mg/kg	6.0E+02	(d)	2.6E+03	J	mg/kg	1.0E+03	95% Student's-t UCL	(4)
Lead - coarse fraction	mg/kg	1.2E+03	(d)	2.0E+03		mg/kg	3.0E+03	95% Student's-t UCL	(4)
Lead - fine fraction	mg/kg	1.6E+03	(d)	2.7E+03		mg/kg	3.9E+03	95% Student's-t UCL	(4)
Lead - total (calculated by fine/coarse fraction)	mg/kg	1.3E+03	(d)	2.2E+03		mg/kg	3.2E+03	95% Student's-t UCL	(4)
Manganese	mg/kg	4.9E+02	(d)	1.1E+03		mg/kg	6.6E+02	95% Student's-t UCL	(4)
Mercury	mg/kg	5.1E-01	(c)	6.1E+00		mg/kg	2.5E+00	95% KM Adjusted Gamma UCL	(4)
Thallium	mg/kg	2.6E-01	(d)	6.5E-01		mg/kg	3.6E-01	95% Student's-t UCL	(4)
Vanadium	mg/kg	2.3E+01	(d)	5.0E+01		mg/kg	3.0E+01	95% Student's-t UCL	(4)
Zinc	mg/kg	1.2E+03	(c)	5.6E+03		mg/kg	3.4E+03	95% Adjusted Gamma UCL	(4)

Table 3.23

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls									
Aroclor-1232 (PCB-1232)	µg/kg	--	--	1.1E+03		µg/kg	1.1E+03	Maximum Detected	(6)
Aroclor-1242 (PCB-1242)	µg/kg	--	--	1.1E+03		µg/kg	1.1E+03	Maximum Detected	(6)
Aroclor-1248 (PCB-1248)	µg/kg	--	--	1.9E+03	J	µg/kg	1.9E+03	Maximum Detected	(6)
Aroclor-1254 (PCB-1254)	µg/kg	2.6E+02	(d)	1.8E+03		µg/kg	6.1E+02	95% KM (t) UCL	(4)
Aroclor-1260 (PCB-1260)	µg/kg	1.2E+02	(d)	1.1E+03	J	µg/kg	2.7E+02	95% KM (t) UCL	(4)
Dioxins/Furans (8)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(7)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(7)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
97.5% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Recommended UCL exceeds maximum observation, therefore the EPC is the lower suggested UCL.
(6) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(7) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(8) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.24

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU15 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/kg	--	--	5.3E+00	J	µg/kg	5.3E+00	Maximum Detected	(5)
Ethylbenzene	µg/kg	--	--	2.6E+05	J	µg/kg	2.6E+05	Maximum Detected	(5)
Trichloroethene	µg/kg	1.0E+03	(c)	5.2E+03		µg/kg	2.3E+03	95% KM Adjusted Gamma UCL	(4)
Xylenes (total)	µg/kg	1.0E+05	(b)	2.0E+06	J	µg/kg	1.1E+06	99% KM Chebyshev UCL	(4)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	9.2E+02	(b)	9.6E+03		µg/kg	6.4E+03	99% KM Chebyshev UCL	(4)
Benzo(a)pyrene	µg/kg	8.5E+02	(c)	8.5E+03		µg/kg	3.3E+03	95% KM Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	1.2E+03	(b)	1.2E+04		µg/kg	8.0E+03	99% KM Chebyshev UCL	(4)
Carbazole	µg/kg	1.5E+02	(c)	1.5E+03		µg/kg	5.8E+02	95% KM Adjusted Gamma UCL	(4)
Dibenz(a,h)anthracene	µg/kg	1.5E+02	(c)	1.6E+03		µg/kg	6.4E+02	95% KM Adjusted Gamma UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	5.5E+02	(c)	5.3E+03		µg/kg	2.1E+03	95% KM Adjusted Gamma UCL	(4)
Metals									
Aluminum	mg/kg	8.6E+03	(d)	2.2E+04		mg/kg	1.1E+04	95% Student's-t UCL	(4)
Antimony	mg/kg	9.8E+00	(c)	7.0E+01	J	mg/kg	2.4E+01	95% Adjusted Gamma UCL	(4)
Arsenic	mg/kg	1.7E+01	(d)	5.4E+01		mg/kg	2.2E+01	95% Student's-t UCL	(4)
Barium	mg/kg	8.2E+02	(c)	3.5E+03		mg/kg	1.6E+03	95% Adjusted Gamma UCL	(4)
Cadmium	mg/kg	3.1E+00	(c)	1.6E+01		mg/kg	6.0E+00	95% Adjusted Gamma UCL	(4)
Chromium VI (hexavalent)	mg/kg	1.2E+01	(a)	1.5E+02		mg/kg	7.6E+01	97.5% KM Chebyshev UCL	(4)
Cobalt	mg/kg	3.2E+01	(b)	3.2E+02		mg/kg	1.2E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Copper	mg/kg	5.2E+02	(c)	2.9E+03		mg/kg	1.2E+03	95% Adjusted Gamma UCL	(4)
Cyanide (total)	mg/kg	3.4E+00	(d)	4.1E+01		mg/kg	8.7E+00	95% KM (t) UCL	(4)
Iron	mg/kg	3.2E+04	(a)	1.1E+05		mg/kg	6.6E+04	95% Chebyshev (Mean, Sd) UCL	(4)
Lead	mg/kg	1.7E+03	(c)	1.8E+04		mg/kg	5.2E+03	95% Adjusted Gamma UCL	(4)
Lead - coarse fraction	mg/kg	1.2E+03	(d)	2.0E+03		mg/kg	3.0E+03	95% Student's-t UCL	(4)
Lead - fine fraction	mg/kg	1.6E+03	(d)	2.7E+03		mg/kg	3.9E+03	95% Student's-t UCL	(4)
Lead - total (calculated by fine/coarse fraction)	mg/kg	1.3E+03	(d)	2.2E+03		mg/kg	3.2E+03	95% Student's-t UCL	(4)
Manganese	mg/kg	4.5E+02	(d)	1.1E+03		mg/kg	5.7E+02	95% Student's-t UCL	(4)
Mercury	mg/kg	4.4E-01	(c)	6.1E+00		mg/kg	1.4E+00	95% KM Adjusted Gamma UCL	(4)
Thallium	mg/kg	3.4E-01	(c)	1.4E+00		mg/kg	5.7E-01	95% KM Adjusted Gamma UCL	(4)
Vanadium	mg/kg	2.8E+01	(d)	7.3E+01		mg/kg	3.5E+01	95% Student's-t UCL	(4)
Zinc	mg/kg	2.3E+03	(b)	2.0E+04		mg/kg	1.5E+04	99% Chebyshev (Mean, Sd) UCL	(4)

Table 3.24

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU15 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU15 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls									
Aroclor-1232 (PCB-1232)	µg/kg	--	--	1.1E+03		µg/kg	1.1E+03	Maximum Detected	(5)
Aroclor-1242 (PCB-1242)	µg/kg	1.1E+02	(a)	1.1E+03		µg/kg	5.4E+02	95% KM Chebyshev UCL	(4)
Aroclor-1248 (PCB-1248)	µg/kg	7.0E+02	(a)	8.6E+03		µg/kg	4.1E+03	95% KM Chebyshev UCL	(4)
Aroclor-1254 (PCB-1254)	µg/kg	2.2E+02	(d)	1.8E+03		µg/kg	4.5E+02	95% KM (t) UCL	(4)
Aroclor-1260 (PCB-1260)	µg/kg	1.2E+02	(d)	1.1E+03	J	µg/kg	2.3E+02	95% KM (t) UCL	(4)
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
97.5% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.25

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU16 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean	Data Distribution	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (1)	Medium EPC Rationale
Volatile Organic Compounds									
Vinyl chloride	µg/kg	--	--	8.9E+01	J	µg/kg	8.9E+01	Maximum Detected	(1)
Semi-Volatiles Organic Compounds									
Benzo(a)pyrene	µg/kg	--	--	7.8E+02	J	µg/kg	7.8E+02	Maximum Detected	(1)
Benzo(b)fluoranthene	µg/kg	--	--	1.8E+03	J	µg/kg	1.8E+03	Maximum Detected	(1)
Metals									
Arsenic	mg/kg	--	--	6.2E+00		mg/kg	6.2E+00	Maximum Detected	(1)
Chromium VI (hexavalent)	mg/kg	--	--	1.0E+00		mg/kg	1.0E+00	Maximum Detected	(1)
Cobalt	mg/kg	--	--	3.6E+00		mg/kg	3.6E+00	Maximum Detected	(1)
Iron	mg/kg	--	--	2.3E+04		mg/kg	2.3E+04	Maximum Detected	(1)
Manganese	mg/kg	--	--	3.6E+02		mg/kg	3.6E+02	Maximum Detected	(1)
Thallium	mg/kg	--	--	1.0E-01	J	mg/kg	1.0E-01	Maximum Detected	(1)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	--	--	2.0E+04	J	µg/kg	2.0E+04	Maximum Detected	(1)
Dioxins/Furans (3)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(2)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(2)

Notes:

J - Estimated concentration.
(1) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(2) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(3) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.26

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU16 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/kg	1.9E+01	(d)	2.8E+02	J	µg/kg	5.7E+01	95% KM (t) UCL	(4)
Chlorobenzene	µg/kg	8.3E+03	(d)	1.0E+05		µg/kg	1.7E+04	95% KM (t) UCL	(4)
Ethylbenzene	µg/kg	1.3E+04	(c)	2.1E+05	J	µg/kg	6.9E+04	95% KM Adjusted Gamma UCL	(4)
Tetrachloroethene	µg/kg	1.9E+03	(c)	4.0E+04		µg/kg	1.6E+04	95% KM Adjusted Gamma UCL	(4)
Trichloroethene	µg/kg	1.8E+03	(c)	2.5E+04		µg/kg	8.3E+03	95% KM Adjusted Gamma UCL	(4)
Vinyl chloride	µg/kg	3.3E+01	(d)	2.0E+02	J	µg/kg	6.2E+01	95% KM (t) UCL	(4)
Xylenes (total)	µg/kg	2.9E+04	(c)	5.9E+05	J	µg/kg	2.2E+05	95% KM Adjusted Gamma UCL	(4)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	5.3E+02	(b)	6.4E+03		µg/kg	4.8E+03	99% KM Chebyshev UCL	(4)
Benzo(a)pyrene	µg/kg	4.2E+02	(c)	4.5E+03		µg/kg	2.4E+03	95% KM Adjusted Gamma UCL	(4)
Benzo(b)fluoranthene	µg/kg	6.8E+02	(c)	6.2E+03		µg/kg	2.9E+03	95% KM Adjusted Gamma UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	2.2E+02	(c)	2.3E+03		µg/kg	1.2E+03	95% KM Adjusted Gamma UCL	(4)
Naphthalene	µg/kg	1.3E+03	(c)	9.8E+03		µg/kg	4.9E+03	95% KM Adjusted Gamma UCL	(4)
Metals									
Aluminum	mg/kg	7.4E+03	(c)	2.1E+04		mg/kg	1.0E+04	95% Adjusted Gamma UCL	(4)
Antimony	mg/kg	1.7E+01	(b)	1.9E+02	J	mg/kg	1.4E+02	99% Chebyshev (Mean, Sd) UCL	(4)
Arsenic	mg/kg	1.6E+01	(d)	3.0E+01		mg/kg	1.9E+01	95% Student's-t UCL	(4)
Barium	mg/kg	1.6E+03	(c)	7.8E+03		mg/kg	3.5E+03	95% Adjusted Gamma UCL	(4)
Cadmium	mg/kg	5.5E+00	(c)	2.9E+01		mg/kg	1.2E+01	95% KM Adjusted Gamma UCL	(4)
Chromium VI (hexavalent)	mg/kg	6.0E+00	(d)	2.6E+01		mg/kg	9.4E+00	95% KM (t) UCL	(4)
Cobalt	mg/kg	1.2E+01	(c)	3.7E+01		mg/kg	1.8E+01	95% Adjusted Gamma UCL	(4)
Copper	mg/kg	1.4E+03	(c)	7.3E+03	J	mg/kg	3.1E+03	95% Adjusted Gamma UCL	(4)
Cyanide (total)	mg/kg	2.5E+00	(a)	1.1E+01		mg/kg	8.6E+00	97.5% KM Chebyshev UCL	(4)
Iron	mg/kg	5.2E+04	(c)	2.1E+05		mg/kg	1.0E+05	95% KM Adjusted Gamma UCL	(4)
Lead	mg/kg	2.3E+03	(c)	1.6E+04		mg/kg	7.1E+03	95% KM Adjusted Gamma UCL	(4)
Manganese	mg/kg	4.5E+02	(c)	1.4E+03		mg/kg	7.4E+02	95% Adjusted Gamma UCL	(4)
Mercury	mg/kg	8.2E-01	(c)	3.9E+00		mg/kg	1.8E+00	95% KM Adjusted Gamma UCL	(4)
Nickel	mg/kg	1.6E+02	(b)	2.0E+03		mg/kg	4.4E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	mg/kg	3.7E-01	(c)	2.4E+00		mg/kg	1.0E+00	95% KM Adjusted Gamma UCL	(4)
Vanadium	mg/kg	2.6E+01	(d)	2.0E+03		mg/kg	3.4E+01	95% Student's-t UCL	(4)
Zinc	mg/kg	2.1E+03	(c)	1.9E+04		mg/kg	5.2E+03	95% Adjusted Gamma UCL	(4)

Table 3.26

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU16 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Surface and Subsurface Soil (0-15 ft BGS)
Exposure Medium: Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls									
Aroclor-1242 (PCB-1242)	µg/kg	2.6E+03	(c)	2.9E+04		µg/kg	1.5E+04	95% KM Adjusted Gamma UCL	(4)
Aroclor-1254 (PCB-1254)	µg/kg	1.4E+03	(c)	1.0E+04		µg/kg	4.1E+03	95% KM Adjusted Gamma UCL	(4)
Pesticides									
Dieldrin	µg/kg	--	--	6.8E+01	J	µg/kg	6.8E+01	Maximum Detected	(5)
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	7.1E+01	(b)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Total TEQ (DL @ Half)	pg/g	7.2E+01	(a)	8.3E+02		pg/g	2.2E+02	97.5% Chebyshev (Mean, Sd) UCL	(4)
Asbestos									
Chrysotile asbestos	%	--	--	6.0E+01		%	6.0E+01	Maximum Detected	(5)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
97.5% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.27

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU17 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	3.7E+02	(d)	1.5E+03	J	µg/kg	5.6E+02	95% Student's-t UCL	(4)
Benzo(a)pyrene	µg/kg	3.7E+02	(d)	1.3E+03		µg/kg	5.5E+02	95% Student's-t UCL	(4)
Benzo(b)fluoranthene	µg/kg	5.8E+02	(d)	1.9E+03		µg/kg	8.6E+02	95% Student's-t UCL	(4)
Carbazole	µg/kg	3.8E+01	(d)	1.1E+02	J	µg/kg	5.5E+01	95% KM (t) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	5.7E+01	(d)	2.0E+02	J	µg/kg	8.6E+01	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	7.8E+03	(d)	1.4E+04		mg/kg	9.6E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	3.5E+01	(c)	2.6E+02		mg/kg	1.4E+02	95% Adjusted Gamma UCL	(4)
Arsenic	mg/kg	1.5E+01	(d)	2.9E+01		mg/kg	1.9E+01	95% Student's-t UCL	(4)
Barium	mg/kg	5.5E+02	(c)	1.8E+03		mg/kg	1.1E+03	95% Adjusted Gamma UCL	(4)
Cadmium	mg/kg	4.5E+00	(c)	2.0E+01		mg/kg	1.2E+01	95% Adjusted Gamma UCL	(4)
Chromium VI (hexavalent)	mg/kg	1.3E+00	(d)	5.4E+00		mg/kg	2.1E+00	95% KM (t) UCL	(4)
Cobalt	mg/kg	1.2E+01	(c)	6.7E+01	J	mg/kg	2.0E+01	95% Adjusted Gamma UCL	(4)
Copper	mg/kg	9.0E+02	(c)	6.0E+03	J	mg/kg	3.2E+03	95% Adjusted Gamma UCL	(4)
Cyanide (total)	mg/kg	3.2E+00	(d)	1.3E+01	J	mg/kg	6.9E+00	95% KM (t) UCL	(4)
Iron	mg/kg	1.9E+04	(d)	4.0E+04		mg/kg	2.4E+04	95% Student's-t UCL	(4)
Lead	mg/kg	4.5E+02	(c)	2.4E+03		mg/kg	1.2E+03	95% Adjusted Gamma UCL	(4)
Lead - coarse fraction	mg/kg	1.1E+03	(c)	4.5E+03	J	mg/kg	2.3E+04	95% Adjusted Gamma UCL	(4)
Lead - fine fraction	mg/kg	7.8E+02	(d)	2.5E+03		mg/kg	1.8E+03	95% Student's-t UCL	(4)
Lead - total (calculated by fine/coarse fraction)	mg/kg	1.1E+03	(c)	4.1E+03		mg/kg	2.0E+04	95% Adjusted Gamma UCL	(4)
Manganese	mg/kg	4.7E+02	(d)	7.6E+02		mg/kg	5.7E+02	95% Student's-t UCL	(4)
Nickel	mg/kg	6.1E+01	(c)	3.3E+02		mg/kg	1.3E+02	95% Adjusted Gamma UCL	(4)
Thallium	mg/kg	2.4E-01	(d)	5.1E-01	J	mg/kg	3.1E-01	95% Student's-t UCL	(4)
Vanadium	mg/kg	2.4E+01	(d)	4.2E+01		mg/kg	2.9E+01	95% Student's-t UCL	(4)
Zinc	mg/kg	7.5E+02	(c)	4.5E+03	J	mg/kg	2.0E+03	95% Adjusted Gamma UCL	(4)

Table 3.27

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU17 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	3.4E+02	(c)	1.7E+03		µg/kg	1.1E+03	95% KM Adjusted Gamma UCL	(4)
Dioxins/Furans (6)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(5)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(5)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(6) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.28

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/kg	--	--	5.6E+02	J	µg/kg	5.6E+02	Maximum Detected	(5)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	9.4E+02	(b)	8.5E+03		µg/kg	2.6E+03	95% KM Chebyshev UCL	(4)
Benzo(a)pyrene	µg/kg	7.7E+02	(b)	6.0E+03		µg/kg	2.0E+03	95% KM Chebyshev UCL	(4)
Benzo(b)fluoranthene	µg/kg	1.2E+03	(b)	9.5E+03		µg/kg	3.1E+03	95% KM Chebyshev UCL	(4)
Carbazole	µg/kg	7.1E+01	(a)	8.7E+02		µg/kg	2.4E+02	95% KM Chebyshev UCL	(4)
Dibenz(a,h)anthracene	µg/kg	1.9E+02	(c)	1.6E+03		µg/kg	4.0E+02	95% KM Adjusted Gamma UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	6.0E+02	(b)	5.0E+03		µg/kg	1.5E+03	95% KM Chebyshev UCL	(4)
Metals									
Aluminum	mg/kg	5.5E+03	(d)	1.2E+04		mg/kg	6.3E+03	95% Student's-t UCL	(4)
Antimony	mg/kg	7.3E+00	(b)	5.2E+01		mg/kg	1.7E+01	95% KM Chebyshev UCL	(4)
Arsenic	mg/kg	1.9E+01	(b)	7.7E+01		mg/kg	3.4E+01	95% Chebyshev (Mean, Sd) UCL	(4)
Cadmium	mg/kg	3.9E+00	(b)	3.4E+01		mg/kg	9.1E+00	95% KM Chebyshev UCL	(4)
Chromium VI (hexavalent)	mg/kg	3.0E+00	(c)	1.6E+01		mg/kg	4.4E+00	95% KM Adjusted Gamma UCL	(4)
Cobalt	mg/kg	8.0E+00	(d)	2.2E+01		mg/kg	9.5E+00	95% KM (t) UCL	(4)
Copper	mg/kg	6.2E+03	(a)	1.9E+05		mg/kg	3.1E+04	95% Chebyshev (Mean, Sd) UCL	(4)
Cyanide (total)	mg/kg	4.9E-01	(b)	3.7E+00		mg/kg	5.7E-01	95% KM H-UCL	(4)
Iron	mg/kg	2.2E+04	(b)	9.4E+04		mg/kg	4.0E+04	95% Chebyshev (Mean, Sd) UCL	(4)
Lead	mg/kg	1.1E+03	(b)	1.3E+04		mg/kg	4.4E+03	97.5% Chebyshev (Mean, Sd) UCL	(4)
Lead - coarse fraction	mg/kg	1.4E+03	(b)	6.4E+03		mg/kg	1.4E+04	99% Chebyshev (Mean, Sd) UCL	(4)
Lead - fine fraction	mg/kg	1.0E+03	(b)	4.2E+03		mg/kg	4.5E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Lead - total (calculated by fine/coarse fraction)	mg/kg	1.3E+03	(b)	5.9E+03		mg/kg	1.3E+04	99% Chebyshev (Mean, Sd) UCL	(4)
Manganese	mg/kg	3.0E+02	(d)	1.4E+03		mg/kg	3.8E+02	95% Student's-t UCL	(4)
Nickel	mg/kg	6.1E+01	(b)	4.0E+02		mg/kg	1.2E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	mg/kg	8.8E-01	(c)	4.5E+00		mg/kg	1.3E+00	95% KM Adjusted Gamma UCL	(4)
Vanadium	mg/kg	2.7E+01	(c)	9.3E+01		mg/kg	3.5E+01	95% Adjusted Gamma UCL	(4)
Zinc	mg/kg	8.0E+02	(b)	1.2E+04		mg/kg	2.4E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1242 (PCB-1242)	µg/kg	6.8E+01	(a)	7.7E+02		µg/kg	2.8E+02	95% KM Chebyshev UCL	(4)
Aroclor-1248 (PCB-1248)	µg/kg	1.7E+02	(d)	4.2E+03	X	µg/kg	4.3E+02	95% KM (t) UCL	(4)
Aroclor-1254 (PCB-1254)	µg/kg	1.4E+03	(b)	2.9E+04		µg/kg	7.0E+03	95% KM Chebyshev UCL	(4)
Aroclor-1260 (PCB-1260)	µg/kg	2.3E+02	(d)	2.8E+03	X	µg/kg	4.0E+02	95% KM (t) UCL	(4)

Table 3.28

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Dioxins/Furans (7)									
Total TEQ (DL @ 0)	pg/g	9.9E+00	(c)	4.6E+01		pg/g	4.6E+01	Maximum Detected	(6)
Total TEQ (DL @ Half)	pg/g	1.1E+01	(c)	5.0E+01		pg/g	5.0E+01	Maximum Detected	(6)
Asbestos									
Chrysotile asbestos	%	2.7E-01	(d)	5.0E-01		%	3.2E-01	95% KM (t) UCL	(4)

Notes:

J - Estimated concentration.
X - Unknown description.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1):
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
97.5% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to the limited dataset an EPC could not be calculated, therefore the maximum detected is the EPC for the surface soil exposure.
(6) The calculated EPC is greater than the maximum detected, therefore the maximum detected is the EPC for the surface soil exposure.
(7) Due to similar EPCs, the EPC used in the calculation of risk/hazard will be based on the EPC for Total TEQ (ND=0).

Table 3.29

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU3-EU4 Soil Vapor (Jim City)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU3-EU4 Soil Vapor (Jim City)
Exposure Medium: Indoor Air

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,2,4-Trimethylbenzene	µg/m^3	--	--	8.4E+03	J	µg/m^3	8.4E+03	Maximum Detected	(1)
Benzene	µg/m^3	--	--	1.1E+05		µg/m^3	1.1E+05	Maximum Detected	(1)
Cyclohexane	µg/m^3	--	--	2.3E+05		µg/m^3	2.3E+05	Maximum Detected	(1)
Ethylbenzene	µg/m^3	--	--	1.4E+05		µg/m^3	1.4E+05	Maximum Detected	(1)
Hexane	µg/m^3	--	--	6.3E+05		µg/m^3	6.3E+05	Maximum Detected	(1)
Isopropyl benzene (Cumene)	µg/m^3	--	--	9.8E+03	J	µg/m^3	9.8E+03	Maximum Detected	(1)
N-Heptane	µg/m^3	--	--	1.1E+06		µg/m^3	1.1E+06	Maximum Detected	(1)
Toluene	µg/m^3	--	--	1.7E+06		µg/m^3	1.7E+06	Maximum Detected	(1)
Xylenes (total)	µg/m^3	--	--	7.7E+05		µg/m^3	7.7E+05	Maximum Detected	(1)

Notes:

J - Estimated concentration.

(1) Due to limited data set (less than 10 samples), the EPC is the maximum detected concentration.

Table 3.30

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU5-EU8 Soil Vapor (Barnett)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU5-EU8 Soil Vapor (Barnett)
Exposure Medium: Indoor Air

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
Trichloroethene	µg/m^3	--	--	6.9E+02		µg/m^3	6.9E+02	Maximum Detected	(1)

Note:

(1) Due to limited data set (less than 10 samples), the EPC is the maximum detected concentration.

Table 3.31

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU9-EU15 Soil Vapor (Dryden Rd.)
Exposure Medium: Indoor Air

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/m^3	1.9E+02	(c)	3.2E+03		µg/m^3	1.4E+03	95% KM Adjusted Gamma UCL	(4)
Carbon tetrachloride	µg/m^3	3.2E+00	(d)	3.6E+01		µg/m^3	7.4E+00	95% KM (t) UCL	(4)
Chloroform (Trichloromethane)	µg/m^3	9.7E+00	(c)	1.1E+02	J	µg/m^3	4.0E+01	95% KM Adjusted Gamma UCL	(4)
Tetrachloroethene	µg/m^3	3.5E+01	(c)	3.7E+02		µg/m^3	1.3E+02	95% KM Adjusted Gamma UCL	(4)
Trichloroethene	µg/m^3	5.9E+03	(c)	5.6E+04		µg/m^3	2.0E+04	95% KM Adjusted Gamma UCL	(4)
Vinyl chloride	µg/m^3	2.5E+01	(c)	3.7E+02		µg/m^3	1.6E+02	95% KM Adjusted Gamma UCL	(4)

Notes:

J - Estimated concentration.

(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).

(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:

(a) Data set is neither normally, gamma or lognormally distributed.

(b) Data set is lognormally distributed.

(c) Data set is gamma distributed.

(d) Data set is normally distributed.

(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.

95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value

95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50

(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.

(5) Only one distinct data value was detected. ProUCL (or any other software) should not be used on such a data set, therefore the recommended EPC value is the maximum detected concentration.

Table 3.32

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU16 Soil Vapor (Valley Asphalt)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU16 Soil Vapor (Valley Asphalt)
Exposure Medium: Indoor Air

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/m^3	--	--	4.0E+02	J	µg/m^3	4.0E+02	Maximum Detected	(1)
Benzene	µg/m^3	--	--	1.4E+04		µg/m^3	1.4E+04	Maximum Detected	(1)
Chlorobenzene	µg/m^3	--	--	1.1E+05		µg/m^3	1.1E+05	Maximum Detected	(1)
Cyclohexane	µg/m^3	--	--	5.0E+04		µg/m^3	5.0E+04	Maximum Detected	(1)
Ethylbenzene	µg/m^3	--	--	4.8E+04		µg/m^3	4.8E+04	Maximum Detected	(1)
Isopropyl benzene (Cumene)	µg/m^3	--	--	4.1E+03		µg/m^3	4.1E+03	Maximum Detected	(1)
Naphthalene	µg/m^3	--	--	9.8E+02	J	µg/m^3	9.8E+02	Maximum Detected	(1)
N-Heptane	µg/m^3	--	--	1.6E+03		µg/m^3	1.6E+03	Maximum Detected	(1)
Trichloroethene	µg/m^3	--	--	3.6E+02		µg/m^3	3.6E+02	Maximum Detected	(1)
Vinyl chloride	µg/m^3	--	--	4.8E+03		µg/m^3	4.8E+03	Maximum Detected	(1)
Xylenes (total)	µg/m^3	--	--	4.7E+04		µg/m^3	4.7E+04	Maximum Detected	(1)

Notes:

J - Estimated concentration.
(1) Due to limited data set (less than 10 samples), the EPC is the maximum detected concentration.

Table 3.33

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU18-EU19 Soil Vapor (Central)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: EU18-EU19 Soil Vapor (Central)
Exposure Medium: Indoor Air

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,4-Dichlorobenzene	µg/m^3	--	--	7.4E+01	J	µg/m^3	7.4E+01	Maximum Detected	(5)
Benzene	µg/m^3	6.0E+01	(c)	4.1E+02		µg/m^3	3.5E+02	95% KM Bootstrap t UCL	(4)
Chlorobenzene	µg/m^3	1.0E+03	(d)	9.2E+03		µg/m^3	2.7E+03	95% KM (t) UCL	(4)
Chloroform (Trichloromethane)	µg/m^3	2.9E+00	(a)	1.8E+01		µg/m^3	1.4E+01	95% KM Chebyshev UCL	(4)
Dichlorodifluoromethane (CFC-12)	µg/m^3	9.3E+01	(c)	5.7E+02		µg/m^3	1.0E+03	95% KM Bootstrap t UCL	(4)
Ethylbenzene	µg/m^3	2.0E+01	(c)	1.5E+02		µg/m^3	1.6E+02	95% KM Bootstrap t UCL	(4)
Hexane	µg/m^3	5.2E+02	(c)	3.1E+03		µg/m^3	2.4E+03	95% Adjusted Gamma UCL	(4)
N-Heptane	µg/m^3	2.7E+02	(c)	1.8E+03		µg/m^3	1.3E+03	95% KM Gamma Adjusted UCL	(4)
Tetrachloroethene	µg/m^3	5.9E+01	(d)	5.5E+02		µg/m^3	1.6E+02	95% KM (t) UCL	(4)
Trichloroethene	µg/m^3	7.8E+01	(c)	5.9E+02		µg/m^3	4.7E+02	95% KM Gamma Adjusted UCL	(4)
Vinyl chloride	µg/m^3	4.3E+01	(b)	2.0E+02		µg/m^3	1.3E+02	95% KM Gamma Adjusted UCL	(4)
Xylenes (total)	µg/m^3	9.7E+01	(c)	6.6E+02		µg/m^3	5.2E+02	95% KM Bootstrap t UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% Adjusted Gamma UCL = adjusted gamma UCL using chi-square
95% KM Adjusted Gamma UCL = adjusted gamma UCL based upon Kaplan-Meier Estimates for non-detects using chi-square
95% KM Bootstrap t UCL = UCL based upon Kaplan-Meier Estimates using the Bootstrap t Method.
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Only one distinct data value was detected. ProUCL (or any other software) should not be used on such a data set, therefore the recommended EPC value is the maximum detected concentration.

Table 3.34

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Outside of OU1 Soil Vapor (South)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Outside of OU1 Soil Vapor (South)
Exposure Medium: Indoor Air

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
Bromodichloromethane	µg/m^3	--	--	5.3E+00		µg/m^3	5.3E+00	Maximum Detected	(1)
Chloroform (Trichloromethane)	µg/m^3	--	--	2.6E+02		µg/m^3	2.6E+02	Maximum Detected	(1)

Notes:

(1) Due to limited data set (less than 10 samples), the EPC is the maximum detected concentration.

Table 3.35

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Indoor Air
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Indoor Air
Exposure Medium: Indoor Air

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,4-Dioxane	µg/m^3	--	--	2.2E+00		µg/m^3	2.2E+00	Maximum Detected	(1)
Benzene	µg/m^3	--	--	8.0E-01		µg/m^3	8.0E-01	Maximum Detected	(1)
Carbon tetrachloride	µg/m^3	--	--	4.8E-01	J	µg/m^3	4.8E-01	Maximum Detected	(1)

Notes:
J - Estimated concentration.
(1) Due to limited data set (less than 10 samples), the EPC is the maximum detected concentration.

Table 3.36

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Groundwater - Upper and Lower Aquifers
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper and Lower Aquifers
Exposure Medium: Tapwater

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/L	5.1E-01	(a)	2.3E+01	J	µg/L	1.1E+00	95% KM Chebyshev UCL	(4)
1,2,4-Trichlorobenzene	µg/L	--	--	1.2E+00	J	µg/L	1.2E+00	Maximum Detected	(5)
1,2-Dibromo-3-chloropropane (DBCP)	µg/L	--	--	9.6E-03	NJ	µg/L	9.6E-03	Maximum Detected	(5)
1,2-Dichloroethane	µg/L	2.2E-01	(a)	2.0E+00	J	µg/L	2.5E-01	95% KM (t) UCL	(5)
1,4-Dichlorobenzene	µg/L	2.3E-01	(b)	5.6E+00		µg/L	2.1E-01	95% KM H-UCL	(4)
Benzene	µg/L	3.0E+00	(a)	3.9E+02		µg/L	1.1E+01	95% KM Chebyshev UCL	(4)
Bromodichloromethane	µg/L	1.9E-01	(d)	1.1E+00		µg/L	2.1E-01	95% KM (t) UCL	(4)
Chlorobenzene	µg/L	8.8E-01	(c)	4.0E+01		µg/L	1.4E+00	95% KM Approximate Gamma UCL	(4)
Chloroform (Trichloromethane)	µg/L	2.4E-01	(c)	1.8E+00		µg/L	2.7E-01	95% KM Approximate Gamma UCL	(4)
cis-1,2-Dichloroethene	µg/L	1.9E+01	(a)	1.1E+03		µg/L	4.5E+01	95% KM Chebyshev UCL	(4)
Ethylbenzene	µg/L	7.0E-01	(a)	1.0E+02		µg/L	2.8E+00	95% KM Chebyshev UCL	(4)
Methylene chloride	µg/L	6.5E-01	(d)	1.5E+01	J	µg/L	8.2E-01	95% KM (t) UCL	(5)
Toluene	µg/L	2.3E+00	(a)	2.7E+02		µg/L	8.0E+00	95% KM Chebyshev UCL	(4)
Trichloroethene	µg/L	4.0E+00	(a)	9.4E+01		µg/L	8.3E+00	95% KM Chebyshev UCL	(4)
Vinyl chloride	µg/L	1.5E+01	(a)	6.2E+02		µg/L	3.3E+01	95% KM Chebyshev UCL	(4)
Xylenes (total)	µg/L	1.5E+00	(b)	1.9E+02		µg/L	3.9E-01	95% KM H-UCL	(4)
Semi-Volatiles Organic Compounds									
Biphenyl (1,1-Biphenyl)	µg/L	--	--	4.1E-01	J	µg/L	4.1E-01	Maximum Detected	(5)
bis(2-Ethylhexyl)phthalate (DEHP)	µg/L	7.8E+00	(d)	1.6E+02		µg/L	1.8E+01	95% KM (t) UCL	(4)
Naphthalene	µg/L	3.0E-01	(c)	9.8E+00		µg/L	5.8E-01	95% KM Approximate Gamma UCL	(4)
Metals									
Aluminum	µg/L	4.0E+03	(a)	1.2E+05		µg/L	9.1E+03	95% KM Chebyshev UCL	(4)
Antimony	µg/L	1.4E+00	(b)	2.3E+01		µg/L	1.3E+00	95% KM H-UCL	(4)
Arsenic	µg/L	2.1E+01	(a)	8.2E+02	J	µg/L	5.2E+01	95% KM Chebyshev UCL	(4)
Barium	µg/L	4.8E+02	(a)	5.0E+03		µg/L	7.4E+02	95% KM Chebyshev UCL	(4)
Beryllium	µg/L	5.6E-01	(b)	5.4E+00		µg/L	5.4E-01	95% KM H-UCL	(4)
Cadmium	µg/L	5.3E-01	(a)	1.4E+01		µg/L	1.1E+00	95% KM Chebyshev UCL	(4)
Chromium	µg/L	1.9E+01	(a)	6.1E+02		µg/L	4.4E+01	95% KM Chebyshev UCL	(4)

Table 3.36

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Groundwater - Upper and Lower Aquifers
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper and Lower Aquifers
Exposure Medium: Tapwater

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Metals (cont.'d)									
Cobalt	µg/L	5.1E+00	(a)	1.0E+02		µg/L	1.0E+01	95% KM Chebyshev UCL	(4)
Copper	µg/L	3.6E+01	(a)	1.9E+03		µg/L	1.0E+02	95% KM Chebyshev UCL	(4)
Cyanide (total)	µg/L	4.5E+01	(d)	5.8E+02		µg/L	8.7E+01	95% KM (t) UCL	(4)
Iron	µg/L	1.7E+04	(b)	3.9E+05	J	µg/L	2.0E+04	95% KM H-UCL	(4)
Lead	µg/L	2.6E+01	(a)	1.4E+03		µg/L	7.6E+01	95% KM Chebyshev UCL	(4)
Manganese	µg/L	7.0E+02	(b)	1.5E+04		µg/L	8.5E+02	95% KM H-UCL	(4)
Mercury	µg/L	1.4E-01	(d)	5.6E-01		µg/L	1.5E-01	95% KM (t) UCL	(4)
Nickel	µg/L	1.8E+01	(a)	3.1E+02		µg/L	3.6E+01	95% KM Chebyshev UCL	(4)
Selenium	µg/L	3.2E+00	(c)	2.6E+01		µg/L	4.1E+00	95% KM Approximate Gamma UCL	(4)
Thallium	µg/L	6.3E-01	(b)	6.7E+00	J	µg/L	5.6E-01	95% KM H-UCL	(4)
Vanadium	µg/L	1.0E+01	(a)	2.6E+02		µg/L	2.3E+01	95% KM Chebyshev UCL	(4)
Zinc	µg/L	5.6E+02	(b)	5.5E+03	J	µg/L	1.3E+03	95% KM H-UCL	(4)

Notes:

J - Estimated concentration.
N - Tentatively identified compound.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% KM (Chebyshev) UCL = 95% UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic
95% KM Approximate Gamma UCL = approximate gamma UCL based upon Kaplan-Meier Estimates for non-detects using chi-square
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Only one distinct data value was detected. ProUCL (or any other software) should not be used on such a data set, therefore the recommended EPC value is the maximum detected concentration.

Table 3.37

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Groundwater Volatilizing to Indoor Air - Upper Aquifer
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Upper Aquifer
Exposure Medium: Indoor Air

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/L	6.3E-01	(a)	2.3E+01	J	µg/L	1.4E+00	95% KM (Chebyshev) UCL	(4)
1,4-Dichlorobenzene	µg/L	2.7E-01	(b)	5.6E+00		µg/L	2.5E-01	95% KM H-UCL	(4)
Benzene	µg/L	1.6E+00	(a)	1.0E+02		µg/L	5.2E+00	95% KM (Chebyshev) UCL	(4)
Chloroform (Trichloromethane)	µg/L	1.9E-01	(d)	1.3E+00		µg/L	2.3E-01	95% KM (t) UCL	(4)
Ethylbenzene	µg/L	9.6E-01	(a)	1.0E+02		µg/L	3.9E+00	95% KM (Chebyshev) UCL	(4)
Trichloroethene	µg/L	5.4E+00	(a)	9.4E+01		µg/L	1.1E+01	95% KM (Chebyshev) UCL	(4)
Vinyl chloride	µg/L	1.4E+01	(b)	6.2E+02		µg/L	4.5E+00	95% KM H-UCL	(4)
Xylenes (total)	µg/L	2.0E+00	(b)	1.9E+02		µg/L	6.2E-01	95% KM H-UCL	(4)
Semi-Volatiles Organic Compounds									
Naphthalene	µg/L	3.2E-01	(c)	9.8E+00		µg/L	6.0E-01	95% KM Approximate Gamma UCL	(4)
Metals									
Cyanide (total)	µg/L	5.2E+01	(d)	5.8E+02		µg/L	9.9E+01	95% KM (t) UCL	(4)
Mercury	µg/L	1.4E-01	(d)	5.6E-01		µg/L	1.6E-01	95% KM (t) UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% KM (Chebyshev) UCL = 95% UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic
95% KM Approximate Gamma UCL = approximate gamma UCL based upon Kaplan-Meier Estimates for non-detects using chi-square
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.

Table 3.38

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Groundwater - Floodplain
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Floodplain
Exposure Medium: Groundwater

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
Chloroform (Trichloromethane)	µg/L	1.5E-01	(a)	4.5E-01	J	µg/L	2.7E-01	95% KM Chebyshev UCL	(4)
Trichloroethene	µg/L	1.3E+00	(c)	1.2E+01		µg/L	3.4E+00	95% KM Adjusted Gamma UCL	(4)
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/L	--	--	2.4E-01		µg/L	2.4E-01	Maximum Detected	(5, 6)
Benzo(a)pyrene	µg/L	--	--	3.6E-01		µg/L	3.6E-01	Maximum Detected	(5, 6)
Benzo(b)fluoranthene	µg/L	--	--	4.2E-01		µg/L	4.2E-01	Maximum Detected	(5, 6)
Indeno(1,2,3-cd)pyrene	µg/L	--	--	3.2E-01		µg/L	3.2E-01	Maximum Detected	(5, 6)
Metals									
Aluminum	µg/L	2.1E+04	(b)	1.7E+05		µg/L	1.4E+05	99% Chebyshev (Mean, Sd) UCL	(4)
Antimony	µg/L	1.2E+00	(d)	5.7E+00		µg/L	1.8E+00	95% KM (t) UCL	(4)
Arsenic	µg/L	3.8E+01	(b)	3.6E+02		µg/L	2.6E+02	99% KM Chebyshev UCL	(4)
Barium	µg/L	4.3E+02	(a)	2.5E+03		µg/L	1.1E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Beryllium	µg/L	1.5E+00	(a)	1.2E+01		µg/L	4.9E+00	95% KM Chebyshev UCL	(4)
Cadmium	µg/L	7.0E-01	(c)	4.4E+00		µg/L	1.7E+00	95% KM Adjusted Gamma UCL	(4)
Chromium	µg/L	5.5E+01	(b)	5.1E+02		µg/L	3.6E+02	99% KM Chebyshev UCL	(4)
Cobalt	µg/L	1.9E+01	(b)	1.9E+02		µg/L	1.4E+02	99% KM Chebyshev UCL	(4)
Copper	µg/L	7.3E+01	(b)	4.2E+02		µg/L	4.1E+02	99% KM Chebyshev UCL	(4)
Iron	µg/L	6.1E+04	(b)	5.0E+05		µg/L	4.1E+05	99% KM Chebyshev UCL	(4)
Lead	µg/L	4.2E+01	(b)	3.3E+02		µg/L	2.7E+02	99% Chebyshev (Mean, Sd) UCL	(4)
Manganese	µg/L	1.3E+03	(c)	7.4E+03		µg/L	3.2E+03	95% KM Adjusted Gamma UCL	(4)
Mercury	µg/L	1.5E-01	(a)	3.5E-01		µg/L	1.9E-01	95% KM (t) UCL	(4)
Nickel	µg/L	5.6E+01	(b)	4.8E+02		µg/L	3.7E+02	99% KM Chebyshev UCL	(4)
Selenium	µg/L	4.8E+00	(d)	1.9E+01		µg/L	7.4E+00	95% KM (t) UCL	(4)
Thallium	µg/L	7.7E-01	(a)	5.4E+00		µg/L	2.3E+00	95% KM Chebyshev UCL	(4)
Vanadium	µg/L	5.2E+01	(b)	4.7E+02		µg/L	3.7E+02	99% KM Chebyshev UCL	(4)
Zinc	µg/L	6.3E+02	(c)	4.1E+03		µg/L	1.4E+03	95% KM Adjusted Gamma UCL	(4)

Table 3.38

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Groundwater - Floodplain
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - Floodplain
Exposure Medium: Groundwater

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls									
Aroclor-1248 (PCB-1248)	µg/L	--	--	3.9E-01		µg/L	3.9E-01	Maximum Detected	(5, 6)
Aroclor-1260 (PCB-1260)	µg/L	--	--	8.2E-02	J	µg/L	8.2E-02	Maximum Detected	(5, 6)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% KM Chebyshev UCL = 95% UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
99% KM Chebyshev UCL = 99% UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
99% Chebyshev (Mean, Sd) UCL = UCL of mean and standard deviation using the Chebyshev Inequality
95% KM Adjusted Gamma UCL = adjusted gamma UCL based upon Kaplan-Meier Estimates for non-detects using chi-square
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to limited data set (less than 10 samples), the EPC is the maximum detected concentration.
(6) Only one distinct data value was detected. ProUCL (or any other software) should not be used on such a data set, therefore the recommended EPC value is the maximum detected concentration.

Table 3.39

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Groundwater - OU1 Upper Aquifer (EU1 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - OU1 Upper Aquifer (EU1 & EU19)
Exposure Medium: Groundwater

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,1-Dichloroethane	µg/L	1.0E+00	(d)	5.2E+00		µg/L	1.8E+00	95% KM (t) UCL	(4)
Benzene	µg/L	5.3E-01	(d)	2.4E+00	J	µg/L	9.2E-01	95% KM (t) UCL	(4)
Bromodichloromethane	µg/L	--	--	3.6E-01	J	µg/L	3.6E-01	Maximum Detected	(6)
Chlorobenzene	µg/L	1.2E+01	(c)	1.3E+02		µg/L	1.1E+02	95% Gamma Adjusted KM-UCL	(4)
Chloroform (Trichloromethane)	µg/L	--	--	3.2E-01	J	µg/L	3.2E-01	Maximum Detected	(6)
Ethylbenzene	µg/L	5.6E-01	(a)	4.5E+00	J	µg/L	3.9E+00	97.5% KM Chebyshev UCL	(4)
Trichloroethene	µg/L	--	--	2.4E+00	J	µg/L	2.4E+00	Maximum Detected	(6)
Vinyl chloride	µg/L	4.4E-01	(d)	1.7E+00		µg/L	7.4E-01	95% KM (t) UCL	(4)
Semi-Volatiles Organic Compounds									
bis(2-Ethylhexyl)phthalate (DEHP)	µg/L	--	--	1.6E+02		µg/L	1.6E+02	Maximum Detected	(5)
Naphthalene	µg/L	--	--	4.9E+00		µg/L	4.9E+00	Maximum Detected	(4)
Metals									
Aluminum	µg/L	--	--	1.5E+04	J	µg/L	1.5E+04	Maximum Detected	(5)
Antimony	µg/L	--	--	1.3E+01		µg/L	1.3E+01	Maximum Detected	(5)
Arsenic	µg/L	--	--	6.6E+01		µg/L	6.6E+01	Maximum Detected	(5)
Barium	µg/L	--	--	1.5E+03		µg/L	1.5E+03	Maximum Detected	(5)
Cadmium	µg/L	--	--	4.0E+00		µg/L	4.0E+00	Maximum Detected	(5)
Chromium	µg/L	--	--	3.6E+01		µg/L	3.6E+01	Maximum Detected	(5)
Cobalt	µg/L	--	--	1.4E+01	J	µg/L	1.4E+01	Maximum Detected	(5)
Copper	µg/L	--	--	1.7E+02		µg/L	1.7E+02	Maximum Detected	(5)
Iron	µg/L	--	--	3.5E+04	J	µg/L	3.5E+04	Maximum Detected	(5)
Lead	µg/L	--	--	3.4E+02		µg/L	3.4E+02	Maximum Detected	(5)
Manganese	µg/L	--	--	1.3E+03		µg/L	1.3E+03	Maximum Detected	(5)
Nickel	µg/L	--	--	4.6E+01		µg/L	4.6E+01	Maximum Detected	(5)
Thallium	µg/L	--	--	5.8E-01	J	µg/L	5.8E-01	Maximum Detected	(5)

Table 3.39

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Groundwater - OU1 Upper Aquifer (EU1 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater - OU1 Upper Aquifer (EU1 & EU19)
Exposure Medium: Groundwater

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Metals (cont.'d)									
Vanadium	µg/L	--	--	3.7E+01	J	µg/L	3.7E+01	Maximum Detected	(5)
Zinc	µg/L	--	--	1.2E+03		µg/L	1.2E+03	Maximum Detected	(5)

Notes:

J - Estimated concentration.
N - Tentatively identified compound.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
97.5% KM Chebyshev UCL = 97.55% UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% KM Adjusted Gamma UCL = adjusted gamma UCL based upon Kaplan-Meier Estimates for non-detects using chi-square
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Due to limited data set (less than 10 samples), the EPC is the maximum detected concentration.
(6) Only one distinct data value was detected. ProUCL (or any other software) should not be used on such a data set, therefore the recommended EPC value is the maximum detected concentration.

Table 3.40

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Quarry Pond Sediment
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Sediment

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Metals									
Arsenic	mg/kg	--	--	1.1E+01		mg/kg	1.1E+01	Maximum Detected	(1)
Chromium	mg/kg	--	--	1.3E+01		mg/kg	1.3E+01	Maximum Detected	(1)

Notes:
J - Estimated concentration.
(1) Due to limited data set (less than 10 samples), the EPC is the maximum detected concentration.

Table 3.41

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Quarry Pond Sediment Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Fish Tissue

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Acenaphthene	µg/kg	1.1E+02	(b)	2.9E+03		µg/kg	1.3E+02	95% KM H-UCL	(4)
Acenaphthylene	µg/kg	1.8E+01	(b)	1.2E+02		µg/kg	2.3E+01	95% KM H-UCL	(4)
Anthracene	µg/kg	3.2E+02	(b)	7.8E+03		µg/kg	1.2E+03	95% KM Chebyshev UCL	(4)
Benzo(a)anthracene	µg/kg	1.2E+03	(a)	2.6E+04		µg/kg	4.2E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Benzo(a)pyrene	µg/kg	1.1E+03	(b)	2.2E+04		µg/kg	3.6E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Benzo(b)fluoranthene	µg/kg	1.5E+03	(b)	3.3E+04		µg/kg	5.4E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Benzo(g,h,i)perylene	µg/kg	5.5E+02	(a)	1.1E+04		µg/kg	1.8E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Benzo(k)fluoranthene	µg/kg	5.0E+02	(a)	9.3E+03		µg/kg	1.6E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Chrysene	µg/kg	1.3E+03	(b)	2.9E+04		µg/kg	4.7E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Dibenz(a,h)anthracene	µg/kg	1.7E+02	(b)	3.7E+03		µg/kg	2.2E+02	95% KM H-UCL	(4)
Fluoranthene	µg/kg	2.5E+03	(a)	5.9E+04		µg/kg	9.4E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Fluorene	µg/kg	1.2E+02	(b)	3.0E+03		µg/kg	1.4E+02	95% KM H-UCL	(4)
Indeno(1,2,3-cd)pyrene	µg/kg	5.3E+02	(a)	1.1E+04		µg/kg	1.8E+03	95% KM Chebyshev UCL	(4)
Phenanthrene	µg/kg	1.5E+03	(a)	3.7E+04		µg/kg	5.8E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Pyrene	µg/kg	1.9E+03	(b)	4.1E+04		µg/kg	6.7E+03	95% Chebyshev (Mean, Sd) UCL	(4)
Metals									
Arsenic	mg/kg	1.2E+01	(d)	2.4E+01		mg/kg	1.3E+01	95% Student's-t UCL	(4)
Cadmium	mg/kg	4.1E-01	(d)	8.6E-01		mg/kg	4.7E-01	95% Student's-t UCL	(4)
Chromium	mg/kg	1.4E+01	(d)	2.0E+01		mg/kg	1.5E+01	95% Student's-t UCL	(4)
Copper	mg/kg	2.3E+01	(d)	3.9E+01		mg/kg	2.6E+01	95% Student's-t UCL	(4)
Lead	mg/kg	3.6E+01	(c)	1.4E+02		mg/kg	4.7E+01	95% Adjusted Gamma UCL	(4)
Methyl mercury	mg/kg	2.7E-04	(d)	6.9E-04		mg/kg	3.3E-04	95% KM (t) UCL	(4)
Nickel	mg/kg	1.6E+01	(d)	2.6E+01		mg/kg	1.8E+01	95% Student's-t UCL	(4)
Selenium	mg/kg	8.4E-01	(d)	1.8E+00	J	mg/kg	9.7E-01	95% KM (t) UCL	(4)
Silver	mg/kg	9.4E-02	(d)	3.5E-01	J	mg/kg	1.2E-01	95% KM (t) UCL	(4)
Zinc	mg/kg	9.9E+01	(c)	3.9E+02		mg/kg	1.2E+02	95% Adjusted Gamma UCL	(4)

Table 3.41

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Quarry Pond Sediment Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Sediment
Exposure Medium: Fish Tissue

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Polychlorinated Biphenyls									
Aroclor-1242 (PCB-1242)	µg/kg	4.4E+01	(d)	1.3E+02	J	µg/kg	5.4E-02	95% KM (t) UCL	(4)
Aroclor-1254 (PCB-1254)	µg/kg	4.9E+01	(a)	4.2E+02		µg/kg	1.2E-01	95% KM Chebyshev UCL	(4)
Pesticides									
alpha-Chlordane	µg/kg	--	--	5.5E+00	J	µg/kg	5.5E+00	Maximum Detected	(5)
gamma-Chlordane	µg/kg	2.5E+00	(a)	1.2E+01	J	µg/kg	3.4E+00	95% KM (t) UCL	(4)

Notes:

J - Estimated concentration.

(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).

(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:

(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.

(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.

95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student’s t-Distribution Critical Value
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
95% Chebyshev (Mean, Sd) UCL = 95% Chebyshev UCL of mean and standard deviation using the Chebyshev Inequality
95% Adjusted Gamma UCL = gamma adjusted UCL when n<50
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land’s H-statistic

(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.

(5) Only one distinct data value was detected. ProUCL (or any other software) should not be used on such a data set, therefore the recommended EPC value is the maximum detected concentration.

Table 3.42

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Surface Water

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Metals									
Arsenic	µg/L	2.8E+00	(a)	1.4E+01		µg/L	5.0E+00	95% Chebyshev (Mean, Sd) UCL	(4)
Manganese	µg/L	2.2E+02	(a)	3.0E+03		µg/L	7.5E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	µg/L	2.1E-01	(a)	5.5E-01	J	µg/L	2.8E-01	95% KM Chebyshev UCL	(4)

Notes:

J - Estimated concentration.

(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).

(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:

(a) Data set is neither normally, gamma or lognormally distributed.

(b) Data set is lognormally distributed.

(c) Data set is gamma distributed.

(d) Data set is normally distributed.

(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.

95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value

95% Chebyshev (Mean, Sd) UCL = 95% Chebyshev UCL of mean and standard deviation using the Chebyshev Inequality

95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality

(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.

Table 3.43

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Quarry Pond Surface Water Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Quarry Pond Surface Water
Exposure Medium: Fish Tissue

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Volatile Organic Compounds									
1,2,4-Trichlorobenzene	µg/L	--	--	4.1E-01	J	µg/L	4.1E-01	Maximum Detected	(5)
Semi-Volatiles Organic Compounds									
Butyl benzylphthalate (BBP)	µg/L	--	--	7.9E+00	J	µg/L	7.9E+00	Maximum Detected	(5)
Metals									
Arsenic	µg/L	2.8E+00	(a)	1.4E+01		µg/L	5.0E+00	95% Chebyshev (Mean, Sd) UCL	(4)
Manganese	µg/L	2.2E+02	(a)	3.0E+03		µg/L	7.5E+02	95% Chebyshev (Mean, Sd) UCL	(4)
Thallium	µg/L	2.1E-01	(a)	5.5E-01	J	µg/L	2.8E-01	95% KM Chebyshev UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/L	--	--	7.4E-02	J	µg/L	7.4E-02	Maximum Detected	(5)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1.
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% Chebyshev (Mean, Sd) UCL = 95% Chebyshev UCL of mean and standard deviation using the Chebyshev Inequality
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.
(5) Only one distinct data value was detected. ProUCL (or any other software) should not be used on such a data set, therefore the recommended EPC value is the maximum detected concentration.

Table 3.44

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in Background (Floodplain) Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: Background (Floodplain) Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)pyrene	µg/kg	3.5E+02	(d)	5.4E+02		µg/kg	4.1E+02	95% Student's-t UCL	(4)
Carbazole	µg/kg	4.0E+01	(b)	8.4E+01		µg/kg	4.7E+01	95% KM (t) UCL	(4)
Metals									
Aluminum	mg/kg	1.0E+04	(d)	1.3E+04		mg/kg	1.1E+04	95% Student's-t UCL	(4)
Arsenic	mg/kg	8.8E+00	(d)	1.0E+01		mg/kg	9.2E+00	95% Student's-t UCL	(4)
Chromium VI (hexavalent)	mg/kg	3.7E+00	(a)	6.3E+00		mg/kg	4.3E+00	95% Modified-t UCL	(4)
Cobalt	mg/kg	8.0E+00	(a)	1.3E+01		mg/kg	8.9E+00	95% Modified-t UCL	(4)
Iron	mg/kg	1.9E+04	(a)	2.3E+04		mg/kg	2.0E+04	95% Modified-t UCL	(4)
Manganese	mg/kg	6.0E+02	(a)	1.0E+03		mg/kg	6.8E+02	95% Modified-t UCL	(4)
Thallium	mg/kg	3.1E-01	(d)	3.9E-01		mg/kg	3.4E-01	95% Student's-t UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1254 (PCB-1254)	µg/kg	6.4E+02	(a)	3.3E+03		µg/kg	1.8E+03	95% KM Chebyshev UCL	(4)

Notes:

(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1. See Appendix X for full ProUCL results):
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% Modified-t UCL = 95% UCL of the mean based upon the modified student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student’s t-Distribution Critical Value
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.

Table 3.45

Exposure Point Concentration (EPC) Summary for Chemicals of Potential Concern in EU Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment
South Dayton Dump Site
Moraine, Ohio

Medium: EU Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil

Chemicals of Potential Concern	Units	Mean (1)	Data Distribution (2)	Maximum Detected Concentration	Maximum Qualifier	EPC Units	Medium EPC Value	Medium EPC Statistic (3)	Medium EPC Rationale
Semi-Volatiles Organic Compounds									
Benzo(a)anthracene	µg/kg	5.2E+02	(d)	1.9E+03		µg/kg	6.0E+02	95% Student's-t UCL	(4)
Benzo(a)pyrene	µg/kg	5.5E+02	(d)	1.6E+03		µg/kg	6.3E+02	95% Student's-t UCL	(4)
Benzo(b)fluoranthene	µg/kg	9.2E+02	(d)	2.7E+03		µg/kg	1.0E+03	95% Student's-t UCL	(4)
Carbazole	µg/kg	8.0E+01	(c)	2.8E+02		µg/kg	9.8E+01	95% KM Adjusted Gamma UCL	(4)
Dibenz(a,h)anthracene	µg/kg	6.3E+01	(c)	1.9E+02		µg/kg	7.9E+01	95% KM Adjusted Gamma UCL	(4)
Metals									
Aluminum	mg/kg	6.2E+03	(c)	1.4E+04		mg/kg	7.0E+03	95% Adjusted Gamma UCL	(4)
Arsenic	mg/kg	6.4E+00	(c)	1.2E+01		mg/kg	7.2E+00	95% Adjusted Gamma UCL	(4)
Chromium VI (hexavalent)	mg/kg	4.1E-01	(d)	8.1E-01	J	mg/kg	4.8E-01	95% KM (t) UCL	(4)
Cobalt	mg/kg	4.9E+00	(c)	9.7E+00		mg/kg	5.5E+00	95% Adjusted Gamma UCL	(4)
Iron	mg/kg	1.3E+04	(c)	2.5E+04		mg/kg	1.4E+04	95% Adjusted Gamma UCL	(4)
Manganese	mg/kg	4.2E+02	(d)	6.9E+02		mg/kg	4.5E+02	95% Student's-t UCL	(4)
Thallium	mg/kg	2.1E-01	(c)	4.9E-01		mg/kg	2.4E-01	95% Adjusted Gamma UCL	(4)
Polychlorinated Biphenyls									
Aroclor-1248 (PCB-1248)	µg/kg	1.5E+02	(a)	4.6E+03		µg/kg	6.6E+02	95% KM Chebyshev UCL	(4)
Aroclor-1254 (PCB-1254)	µg/kg	1.0E+02	(b)	8.6E+02		µg/kg	1.3E+02	95% KM H-UCL	(4)

Notes:

J - Estimated concentration.
(1) The Kaplan-Meier estimation method for non-detects was used, as per USEPA (2013).
(2) Data Distribution (Note: data distribution calculated by ProUCL are based on detected values only:
(a) Data set is neither normally, gamma or lognormally distributed.
(b) Data set is lognormally distributed.
(c) Data set is gamma distributed.
(d) Data set is normally distributed.
(3) Statistics (Note: 95% UCL values are calculated using ProUCL software, Version 5.1. See Appendix X for full ProUCL results):
95% Student's-t UCL = UCL of the mean based upon the student's-t statistic
95% KM (t) UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Student's t-Distribution Critical Value
95% KM Adjusted Gamma UCL = gamma adjusted UCL based upon Kaplan-Meier Estimates when n<50
95% KM H-UCL = UCL based upon Kaplan-Meier Estimates for non-detects using Land's H-statistic
95% KM Chebyshev UCL = UCL based upon Kaplan-Meier Estimates for non-detects using the Chebyshev Inequality
(4) ProUCL recommended value is used as the EPC value. In the event of more than one recommended EPC value, the higher EPC value is used.

Table 4.1

Values Used for Daily Intake Calculations - Trespasser Exposure to Surface Soil/ Sediment
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Soil (0-2 ft BGS)/ Sediment
Exposure Medium: Surface Soil/ Sediment
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR	Ingestion Rate of Soil	mg soil/ day	100	USEPA, 2002	100	USEPA, 2002	CS x IR x CF x ABS x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	
	EF	Exposure Frequency	days/year	58	USEPA, 2011 (2)	29	USEPA, 2011 (2)	Mutagenic CDI (mg/kg-day) =
	ED	Exposure Duration	years	10	USEPA, 2018 (3)	10	USEPA, 2018 (3)	CS x MF x IR x CF x ABS x EF x ED x 1/BW x 1/AT-C
	BW	Body Weight	kg	45	USEPA, 2018	45	USEPA, 2018	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	TCE CDI (mg/kg-day) =
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year	days	3,650	USEPA, 1989	3,650	USEPA, 1989	CS x CF x ABS x [(CAF x TCE IFSadj) + (MAF x TCE IFSMadj)] x 1/AT-C
	ABS	Absorption Factor	%/100	chemical-specific	USEPA, 2012 (4)	chemical-specific	USEPA, 2012 (4)	
	MF	Mutagenic Factor	unitless	3	USEPA, 2005 (5)	3	USEPA, 2005 (5)	where TCE IFSadj =
	TCE IFSadj	TCE Ingestion Rate - Toxicity-adjusted	mg-year/kg-day	1,289	USEPA, 2019 (5)	644	USEPA, 2019 (5)	ED x IR x EF / BW
	TCE IFSMadj	TCE Mutagenic Ingestion Rate - Age-adjusted	mg-year/kg-day	3,867	USEPA, 2019 (5)	1,933	USEPA, 2019 (5)	
	CAF	TCE Cancer Adjustment Factor	unitless	0.804	USEPA, 2019 (9)	0.804	USEPA, 2019 (9)	where TCE IFSMadj =
	MAF	TCE Mutagenic Adjust Factor	Unitless	0.202	USEPA, 2019 (9)	0.202	USEPA, 2019 (9)	ED x IR x EF x MF/ BW
Dermal	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2	5,537	USEPA, 2011 (6)	5,537	USEPA, 2011 (6)	CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	
	EF	Exposure Frequency	days/year	58	USEPA, 2011 (2)	29	USEPA, 2011 (2)	Mutagenic CDI (mg/kg-day) =
	ED	Exposure Duration	years	10	USEPA, 2018 (3)	10	USEPA, 2018 (3)	CS x MF x CF x SA x ABS x EF x ED x 1/BW x 1/AT-C
	BW	Body Weight	kg	45	USEPA, 2018	45	USEPA, 2018	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	TCE CDI (mg/kg-day) =
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year	days	3,650	USEPA, 1989	3,650	USEPA, 1989	CS x CF x ABS x [(CAF x TCE DFSadj) + (MAF x TCE DFSMadj)] x 1/AT-C
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.07	USEPA, 2004	0.04	USEPA, 2004	
	ABS	Absorption Factor	%/100	chemical-specific	(7)	chemical-specific	(7)	where DFSadj =
	MF	Mutagenic Factor	unitless	3	USEPA, 2005 (5)	3	USEPA, 2005 (5)	ED x SA x AF x EF / BW
	TCE IFSadj	TCE Ingestion Rate - Toxicity-adjusted	mg-year/kg-day	4,996	USEPA, 2019 (5)	1,427	USEPA, 2019 (5)	
	TCE IFSMadj	TCE Mutagenic Ingestion Rate - Age-adjusted	mg-year/kg-day	14,987	USEPA, 2019 (5)	4,282	USEPA, 2019 (5)	where DFSMadj =
	CAF	TCE Cancer Adjustment Factor	unitless	0.804	USEPA, 2019 (9)	0.804	USEPA, 2019 (9)	ED x SA x AF x EF x MF/ BW
	MAF	TCE Mutagenic Adjust Factor	Unitless	0.202	USEPA, 2019 (9)	0.202	USEPA, 2019 (9)	

Table 4.1

Values Used for Daily Intake Calculations - Trespasser Exposure to Surface Soil/ Sediment
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Soil (0-2 ft BGS)/ Sediment
Exposure Medium: Surface Soil/ Sediment
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Exposure Concentration (EC) (mg/m^3) =
	ET	Exposure Time	unitless	3.9/24	USEPA, 2011 (8)	1.95/24	USEPA, 2011 (8)	CS x ET x EF x ED x 1/(PEF + VF) x 1/AT
	EF	Exposure Frequency	days/year	58	USEPA, 2011 (2)	29	USEPA, 2011 (2)	
	ED	Exposure Duration	years	10	USEPA, 2014 (3)	10	USEPA, 2014 (3)	Mutagenic EC (mg/m^3) =
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	CS x MF x ET x EF x ED x 1/(PEF + VF) x 1/AT-C
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year	days	3,650	USEPA, 1989	3,650	USEPA, 1989	
	PEF	Particulate Emission Factor	m^3/kg	1.36E+09	USEPA, 2002	1.36E+09	USEPA, 2002	
	VF	Volatilization Factor	m^3/kg	chemical-specific	Refer to Table 4.2	chemical-specific	Refer to Table 4.2	TCE EC (mg/m^3) =
	MF	Mutagenic Factor	unitless	3	USEPA, 2005 (5)	3	USEPA, 2005 (5)	CS x 1/(PEF+VF) x 1/AT x [(EF x ED x ET x CAF) + (EF x ED x ET x MAF x MF)]
	CAF	TCE Cancer Adjustment Factor	unitless	0.756	USEPA, 2019 (9)	0.756	USEPA, 2019 (9)	
	MAF	TCE Mutagenic Adjust Factor	Unitless	0.244	USEPA, 2019 (9)	0.244	USEPA, 2019 (9)	

Notes:

(1) For surface soil concentrations, refer to each exposure unit (EU) for EPCs. For sediment concentrations, refer to Table 3.40.
(2) The basis for the EF is the average of the mean time spent outdoors for the age groups 6-11 and 11-16 from Table 16-1, Recommended Values for Activity Factors - Time Outdoors (total).
For 6-11 years old, the time spent outdoors of 132 min/day equals an exposure frequency of 33 days/year [(132 min/d /1440 total min/d)*365].
For 11-16 years old, the time spent outdoors of 100 min/day equals an exposure frequency of 25 days/year [(100 min/d /1440 total min/d)*365].
The average of the age groups 6-11 and 11-16 of 29 days/year is a central tendency value that was doubled to 58 days/year to derive the RME value.
(3) Trespasser is a 7 through 16 year old therefore the exposure duration is 10 years, based on USEPA (2018).
(4) The default assumption of 100% is applied for all parameters with the exception of arsenic at 60%.
(5) Mutagenic ingestion, dermal contact, and inhalation intakes calculated using default age-dependent adjustment factor of 3 for ages >2 to 16 years as applied for carcinogens that act via a mutagenic mode of action.
(6) The basis for SA is the average value for age groups 6 to 11 and 11 to 16 and calculated by summing the mean surface area by body part for face, lower arms, lower legs, feet, and hands from Table 7-2, Recommended Values for Surface Area of Body Parts, Males and Female Children Combined. The surface area of the face was assumed to be one-third the surface area of the head, the surface area of the lower legs was assumed to be 40 percent of the surface area of the legs, and the surface area of the lower arms was assumed to be 45 percent of the surface area of the arms, consistent with USEPA (2004).
(7) USEPA 2004 Exhibit 3-4 and metals of 1% as recommeded by Region 3 Technical Guidance Manual, Risk Assessment https://www.epa.gov/risk/assessing-dermal-exposure-soil
(8) The basis for the ET is the average of the mean time spent outdoors for the age groups 6-11 and 11-16 from Table 16-1, Recommended Values for Activity Factors - Time Outdoors
For 6-11 years old, the time spent outdoors of 132 min/day equates to 2.2 hrs [132/60].
For 11-16 years old, the time spent outdoors of 100 min/day equates to 1.7 hrs [100/60].
The average of the 6-11 and 11-16 ages groups of 1.95 hours is a central tendency value that was doubled to 3.9 hours to derive the RME value.
(9) The adjustment factors are calculated using the equations presented in RSL (2018) and below:

$$CAF_{oral/dermal} = \frac{CSF\ NHL + Liver\ [3.7E\text{-}02\ (mg/kg\text{-}d)^{-1}]}{CSF\ adult\ [4.6E\text{-}02\ (mg/kg\text{-}d)^{-1}]} \qquad MAF_{oral/dermal} = \frac{CSF\ Kidney\ [9.3E\text{-}03\ (mg/kg\text{-}d)^{-1}]}{CSF\ adult\ [4.6E\text{-}02\ (mg/kg\text{-}d)^{-1}]}$$

$$CAF_{inhalation} = \frac{IUR\ NHL + Liver\ [3.1E\text{-}03\ (mg/m^3)^{-1}]}{IUR\ adult\ [4.1E\text{-}03\ (mg/m^3)^{-1}]} \qquad MAF_{inhalation} = \frac{IUR\ Kidney\ [1.0E\text{-}03\ (mg/m^3)^{-1}]}{IUR\ adult\ [4.1E\text{-}03\ (mg/m^3)^{-1}]}$$

References:

Ohio VAP, 2016: Support Document for the Development of Generic Numerical Standards and Risk Assessment Procedures, Table 4: Summary of all scenario and receptor-specific parameters, May 2016.
USEPA, 1989: Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund (RAGS):Volume 1 - Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005, July 2004.
USEPA, 2005: Guidelines for Carcinogenic Risk Assessment and Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, March 2005.
USEPA, 2011: Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, September 2011.
USEPA, 2012: Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil, OSWER 9200.1-113, December 2012.
USEPA, 2018: Region 4 Human Health Risk Assessment Bulletins Supplemental Guidance, Section 4.2.2 Trespasser Scenario, March 2018 Update.
USEPA, 2019: Regional Screening Level User's Guide, May 2019 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm).

Table 4.2

Derivation of Volatilization Factor (VF) for Surface Soil - Trespasser Inhalation Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Input Parameters			Reference	Units	1,1-Dichloroethane CTE/RME	Trichloroethene CTE/RME	Vinyl chloride CTE/RME	Benzo(a)anthracene CTE/RME	Naphthalene CTE/RME	Pyrene CTE/RME	Cyanide (total) CTE/RME	Mercury CTE/RME
VF: Soil-to-Air Volatilization Factor												
$VF = Q/C \times \frac{(3.14 \times D_A \times T)^{1/2}}{(2 \times \rho_b \times D_A)} \times 10^{-4} (m^2/cm^2)$												
Where: **VF**	=	**soil-to-air volatilization factor**	Equation 4-8, USEPA, 2002	m³/kg	**1.6E+03**	**1.7E+03**	**7.4E+02**	**3.4E+06**	**3.6E+04**	**1.9E+06**	**4.2E+04**	**2.7E+04**
Q/C_{vol}	=	inverse of mean conc - centre of square source	Equation D-3, USEPA, 2002	(g/m²-sec)/(kg/m³)	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01
D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	3.1E-03	2.7E-03	1.5E-02	6.8E-10	6.2E-06	2.3E-09	4.7E-06	1.1E-05
T	=	exposure interval	USEPA, 2002	s	3.2E+08	3.2E+08	3.2E+08	3.2E+08	3.2E+08	3.2E+08	3.2E+08	3.2E+08
r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
Q/C_{vol}: Inverse of Mean Conc - Centre of Square Source												
$Q/C_{vol} = A \times \exp \frac{(\ln Area - B)^2}{C}$												
Where: "A"	=	constant	USEPA, 2002 (1)	unitless	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01
Area	=	areal extent of the site or contamination	USEPA, 2002	acres	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01
"B"	=	constant	USEPA, 2002 (1)	unitless	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01
"C"	=	constant	USEPA, 2002 (1)	unitless	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02
D_A: Apparent Diffusivity												
$D_A = \frac{\left[\left(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w\right)/n^2\right]}{\rho_b K_b + \Theta_w + \Theta_a H'}$												
Where: D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	3.1E-03	2.7E-03	1.5E-02	6.8E-10	6.2E-06	2.3E-09	4.7E-06	1.1E-05
Q_a	=	air-filled porosity	USEPA, 2002	unitless	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01
Q_w	=	water-filled porosity	USEPA, 2002	unitless	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
n	=	total soil porosity	USEPA, 2002	unitless	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
H'	=	dimensionless Henry's Law Constant	RSL, 2019	unitless	2.3E-01	4.0E-01	1.1E+00	4.9E-04	1.8E-02	4.9E-04	4.2E-03	3.5E-01
D_i	=	diffusivity of chemical x in air	RSL, 2019	cm²/s	8.4E-02	6.9E-02	1.1E-01	2.6E-02	6.0E-02	2.8E-02	2.1E-01	3.1E-02
D_w	=	diffusivity of chemical x in water	RSL, 2019	cm²/s	1.1E-05	1.0E-05	1.2E-05	6.7E-06	8.4E-06	7.2E-06	2.5E-05	6.3E-06
K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	1.9E-01	3.6E-01	1.3E-01	1.1E+03	9.3E+00	3.3E+02	9.9E+00	5.2E+01
Kd: Soil-Water Partition Coefficient												
$K_d = K_{oc} \times f_{oc}$												
Where: K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	1.9E-01	3.6E-01	1.3E-01	1.1E+03	9.3E+00	3.3E+02	9.9E+00	5.2E+01
K_{oc}	=	soil organic carbon-water partition coefficient	RSL, 2019	cm³/g	3.2E+01	6.1E+01	2.2E+01	1.8E+05	1.5E+03	5.4E+04	--	--
f_{oc}	=	organic content of soil	USEPA, 2002	g/g	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03

Notes:

(1) Refer to Exhibit D-3, Values for the constants (A, B, and C) for Calculating Q/C_{vol}, Zone 7, Cleveland, OH.

References:

Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April 2019.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.

Table 4.2

Derivation of Volatilization Factor (VF) for Soil - Trespasser Inhalation Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Input Parameters			Reference	Units	Aroclor-1232 (PCB-1232) CTE/RME	Aroclor-1242 (PCB-1242) CTE/RME	Aroclor-1248 (PCB-1248) CTE/RME	Aroclor-1254 (PCB-1254) CTE/RME	Aroclor-1260 (PCB-1260) CTE/RME	Heptachlor epoxide CTE/RME	Total TEQ CTE/RME
VF: Soil-to-Air Volatilization Factor											
$VF = Q/C \times \frac{(3.14 \times D_A \times T)^{1/2}}{(2 \times \rho_b \times D_A)} \times 10^{-4} (m^2/cm^2)$											
Where:	**VF**	=	**soil-to-air volatilization factor**	Equation 4-8, USEPA, 2002	m³/kg	**8.7E+04**	**4.6E+05**	**4.9E+05**	**6.6E+05**	**1.0E+06**	**6.6E+05**	**1.5E+06**
	Q/C_{vol}	=	inverse of mean conc - centre of square source	Equation D-3, USEPA, 2002	(g/m²-sec)/(kg/m³)	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01
	D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	1.1E-06	3.8E-08	3.4E-08	1.9E-08	7.7E-09	1.9E-08	3.5E-09
	T	=	exposure interval	USEPA, 2002	s	3.2E+08	3.2E+08	3.2E+08	3.2E+08	3.2E+08	3.2E+08	3.2E+08
	r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
Q/C_{vol}: Inverse of Mean Conc - Centre of Square Source											
$Q/C_{vol} = A \times \exp \frac{(\ln Area - B)^2}{C}$											
Where:	"A"	=	constant	USEPA, 2002 (1)	unitless	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01
	Area	=	areal extent of the site or contamination	USEPA, 2002	acres	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01
	"B"	=	constant	USEPA, 2002 (1)	unitless	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01
	"C"	=	constant	USEPA, 2002 (1)	unitless	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02
D_A: Apparent Diffusivity											
$D_A = \frac{\left[\left(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w\right)/n^2\right]}{\rho_b K_b + \Theta_w + \Theta_a H'}$											
Where:	D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	1.1E-06	3.8E-08	3.4E-08	1.9E-08	7.7E-09	1.9E-08	3.5E-09
	Q_a	=	air-filled porosity	USEPA, 2002	unitless	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01
	Q_w	=	water-filled porosity	USEPA, 2002	unitless	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
	n	=	total soil porosity	USEPA, 2002	unitless	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
	r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
	H'	=	dimensionless Henry's Law Constant	RSL, 2019	unitless	3.0E-02	1.4E-02	1.8E-02	1.2E-02	1.4E-02	8.6E-04	2.0E-03
	D_i	=	diffusivity of chemical x in air	RSL, 2019	cm²/s	3.3E-02	2.4E-02	1.6E-02	2.4E-02	2.2E-02	2.4E-02	4.7E-02
	D_w	=	diffusivity of chemical x in water	RSL, 2019	cm²/s	7.5E-06	6.1E-06	3.9E-06	6.1E-06	5.6E-06	6.2E-06	6.8E-06
	K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	5.0E+01	4.7E+02	4.6E+02	7.8E+02	2.1E+03	6.1E+01	1.5E+03
Kd: Soil-Water Partition Coefficient											
$K_d = K_{oc} \times f_{oc}$											
Where:	K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	5.0E+01	4.7E+02	4.6E+02	7.8E+02	2.1E+03	6.1E+01	1.5E+03
	K_{oc}	=	soil organic carbon-water partition coefficient	RSL, 2019	cm³/g	8.4E+03	7.8E+04	7.7E+04	1.3E+05	3.5E+05	1.0E+04	2.5E+05
	f_{oc}	=	organic content of soil	USEPA, 2002	g/g	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03

Notes:

(1) Refer to Exhibit D-3, Values for the constants (A, B, and C) for Calculating Q/C_{vol}, Zone 7, Cleveland, OH.

References:

Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April 2019.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.

Table 4.3

Values Used for Daily Intake Calculations - Resident Exposure to Surface Soil and Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Soil (0-2 ft BGS)/Soil (0-15 ft BGS)
Exposure Medium: Surface Soil/Soil
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR - child	Ingestion Rate of Soil	mg soil/day	200	USEPA, 2014	200	USEPA, 2014	CS x IR x CF x ABS x EF x ED x 1/BW x 1/AT
	IR - adult	Ingestion Rate of Soil	mg soil/day	100	USEPA, 2014	100	USEPA, 2014	
	IFSMadj	Mutagenic Soil Ingestion Rate - Age-adjusted	mg-year/kg	477	USEPA, 2005 (2)	438	USEPA, 2005 (2)	
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	Mutagenic CDI (mg/kg-day) =
	EF	Exposure Frequency	days/year	350	USEPA, 2014	350	USEPA, 2014	CS x IFSMadj x CF x ABS x EF x 1/AT
	ED - child	Exposure Duration	years	6	USEPA, 2014	6	USEPA, 2004	
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	where IFSMadj =
	BW - child	Body Weight	kg	15	USEPA, 2014	15	USEPA, 2014	(ED_{0-2} x IR-child x 10 / BW-child) + (ED_{2-6} x IR-child x 3 / BW-child) +
	BW - adult	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	(ED_{6-16} x IR-adult x 3 / BW-adult) + (ED_{16-30} x IR-adult x 1 / BW-adult)
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N (child)	Averaging Time (non-cancer) (ED-child x 365 days/year)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	
	AT-N (adult)	Averaging Time (non-cancer) (ED-adult x 365 days/year)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	
	ABS	Absorption Factor	%/100	chemical-specific	USEPA, 2012 (4)	chemical-specific	USEPA, 2012 (4)	
	CAF	TCE Cancer Adjustment Factor	unitless	0.804	USEPA, 2019 (3)	0.804	USEPA, 2019 (3)	TCE CDI (mg/kg-day) =
	MAF	TCE Mutagenic Adjust Factor	unitless	0.202	USEPA, 2019 (3)	0.202	USEPA, 2019 (3)	CS x CF x ABS x [(CAF x TCE IFSadj) + (MAF x TCE IFSMadj)] x 1/AT-C
	TCE IFSadj	TCE Ingestion Rate - Toxicity-adjusted	mg-year/kg-day	36750	USEPA, 2019 (2)	29313	USEPA, 2019 (2)	
	TCE IFSMadj	TCE Mutagenic Ingestion Rate - Age-adjusted	mg-year/kg-day	166833	USEPA, 2019 (2)	153271	USEPA, 2019 (2)	where IFSadj = (ED_{0-2} x IR-child x EF / BW-child) + (ED_{2-6} x IR-child x EF / BW-child) + (ED_{6-16} x IR-adult x EF / BW-adult) + (ED_{16-30} x IR-adult x EF / BW-adult) where IFSMadj = (ED_{0-2} x IR-child x EF x 10 / BW-child) + (ED_{2-6} x IR-child x EF x 3 / BW-child) + (ED_{6-16} x IR-adult x EF x 3 / BW-adult) + (ED_{16-30} x IR-adult x EF x 1 / BW-adult)

Table 4.3

Values Used for Daily Intake Calculations - Resident Exposure to Surface Soil and Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Soil (0-2 ft BGS)/Soil (0-15 ft BGS)
Exposure Medium: Surface Soil/Soil
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Dermal	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	CDI (mg/kg-day) =
	SA - child	Skin Surface Area Available for Contact	cm^2	2,373	USEPA, 2014	2,373	USEPA, 2014	CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
	SA - adult	Skin Surface Area Available for Contact	cm^2	6,032	USEPA, 2014	6,032	USEPA, 2014	
	DFSMadj	Mutagenic soil dermal contact factor - Age-adjusted	mg-year/kg	1,224	USEPA, 2005 (2)	209	USEPA, 2005 (2)	
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	Mutagenic CDI (mg/kg-day) =
	EF	Exposure Frequency	days/year	350	USEPA, 2014	350	USEPA, 2014	CS x CF x DFSMadj x ABS x EF x 1/AT
	ED - child	Exposure Duration	years	6	USEPA, 2014	6	USEPA, 2004	
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	where DFSMadj =
	BW - child	Body Weight	kg	15	USEPA, 2002	15	USEPA, 2002	(ED_{0-2} x AF-child x SA-child x 10 / BW-child) +
	BW - adult	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	(ED_{2-6} x AF-child x SA-child x 3 / BW-child) +
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	(ED_{6-16} x AF-adult x SA-adult x 3 / BW-adult) +
	AT-N (child)	Averaging Time (non-cancer)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	(ED_{16-30} x AF-adult x SA-adult x 1 / BW-adult)
	AT-N (adult)	Averaging Time (non-cancer)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	
	AF - child	Soil to Skin Adherence Factor	mg/cm^2	0.2	USEPA, 2014	0.04	USEPA, 2004	
	AF - adult	Soil to Skin Adherence Factor	mg/cm^2	0.07	USEPA, 2014	0.01	USEPA, 2004	
	ABS	Absorption Factor	%/100	chemical-specific	(5)	chemical-specific	(5)	
	CAF	TCE Cancer Adjustment Factor	unitless	0.804	USEPA, 2019 (3)	0.804	USEPA, 2019 (3)	TCE CDI (mg/kg-day) =
	MAF	TCE Mutagenic Adjust Factor	unitless	0.202	USEPA, 2019 (3)	0.202	USEPA, 2019 (3)	CS x CF x ABS x [(CAF x TCE DFSadj) + (MAF x TCE DFSMadj)] x1/AT
	TCE DFSadj	TCE dermal contact factor - Toxicity-adjusted	mg-year/kg-day	103390	USEPA, 2019 (2)	18567	USEPA, 2019 (2)	
	TCE DFSMadj	TCE Mutagenic dermal contact factor - Age-adjusted	mg-year/kg-day	428260	USEPA, 2019 (2)	73249	USEPA, 2019 (2)	where DFSadj = (ED_{0-2} x AF-child x SA-child x EF / BW-child) + (ED_{2-6} x AF-child x SA-child x EF / BW-child) + (ED_{6-16} x AF-adult x SA-adult x EF / BW-adult) + (ED_{16-30} x AF-adult x SA-adult x EF / BW-adult)
								where DFSMadj = (ED_{0-2} x AF-child x SA-child x EF x 10 / BW-child) + (ED_{2-6} x AF-child x SA-child x EF x 3 / BW-child) + (ED_{6-16} x AF-adult x SA-adult x EF x 3 / BW-adult) + (ED_{16-30} x AF-adult x SA-adult x EF x 1 / BW-adult)

Table 4.3

Values Used for Daily Intake Calculations - Resident Exposure to Surface Soil and Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Soil (0-2 ft BGS)/Soil (0-15 ft BGS)
Exposure Medium: Surface Soil/Soil
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Exposure Concentration (EC) (mg/m^3) =
	FT	Fraction of Time Exposed	unitless	2/24	USEPA, 2011 (6)	1/24	USEPA, 2011 (6)	CS x FT x EF x ED x (1/PEF + VF) x 1/AT
	IFMadj	Mutagenic inhalation factor - Age-adjusted	years	72	USEPA, 2005 (2)	41	USEPA, 2005 (2)	
	EF	Exposure Frequency	days/year	350	USEPA, 2014	350	USEPA, 2014	Mutagenic CDI (mg/m^3) =
	ED - child	Exposure Duration	years	6	USEPA, 2014	6	USEPA, 2004	CS x FT x EF x IFMadj x (1/PEF + VF) x 1/AT
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	where IFMadj =
	AT-N (child)	Averaging Time (non-cancer)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	$(ED_{0-2} \times 10) + (ED_{2-6} \times 3) + (ED_{6-16} \times 3) + (ED_{16-30} \times 1)$
	AT-N (adult)	Averaging Time (non-cancer)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	
	PEF	Particulate Emission Factor	m^3/kg	1.36E+09	USEPA, 2002	1.36E+09	USEPA, 2002	TCE EC (mg/m^3) =
	VF	Volatilization Factor	m^3/kg	chemical-specific	Refer to Table 4.4	chemical-specific	Refer to Table 4.4	CS x (1/PEF + VF) x FT x 1/AT x
	CAF	TCE Cancer Adjustment Factor	unitless	0.756	USEPA, 2019 (3)	0.756	USEPA, 2019 (3)	[(EF x (EDc + EDa) x CAF) +
	MAF	TCE Mutagenic Adjust Factor	unitless	0.244	USEPA, 2019 (3)	0.244	USEPA, 2019 (3)	$((ED_{0-2} \times EF \times MAF \times 10) + (ED_{2-6} \times EF \times MAF \times 3) +$
								$(ED_{6-16} \times EF \times MAF \times 3) + (ED_{16-30} \times EF \times MAF \times 1))]$

Notes:

(1) For surface soil and soil concentrations, refer to each exposure unit (EU) for EPCs. Note for EU5-EU8 only an adult receptor is appropriate for current exposure scenario.
(2) Mutagenic soil ingestion, dermal contact, and inhalation factors calculated using default age-dependent adjustment factor of 10 for ages 0-2 year, 3 for ages >2 to 16 years, and 1 for ages >16 years as applied for carcinogens that act via a mutagenic mode of action.
(3) The adjustment factors are calculated using the equations presented in RSL (2018) and below:

$$CAF_{oral/dermal} = \frac{CSF_{NHL + Liver}\,[3.7E\text{-}02\ (mg/kg\text{-}d)^{-1}]}{CSF_{adult}\,[4.6E\text{-}02\ (mg/kg\text{-}d)^{-1}]} \qquad MAF_{oral/dermal} = \frac{CSF_{Kidney}\,[9.3E\text{-}03\ (mg/kg\text{-}d)^{-1}]}{CSF_{adult}\,[4.6E\text{-}02\ (mg/kg\text{-}d)^{-1}]}$$

$$CAF_{inhalation} = \frac{IUR_{NHL + Liver}\,[.3.1E\text{-}03\ (mg/m^3)^{-1}]}{IUR_{adult}\,[4.1E\text{-}03\ (mg/m^3)^{-1}]} \qquad MAF_{inhalation} = \frac{IUR_{Kidney}\,[1.0E\text{-}03\ (mg/m^3)^{-1}]}{IUR_{adult}\,[4.1E\text{-}03\ (mg/m_3)^{-1}]}$$

(4) The default assumption of 100% is applied for all parameters with the exception of arsenic at 60%.
(5) USEPA 2004 Exhibit 3-4 and metals of 1% as recommeded by Region 3 Technical Guidance Manual, Risk Assessment https://www.epa.gov/risk/assessing-dermal-exposure-soil
(6) RME exposure time is based on the 95th percentile playing on sand/gravel or grass of 121 minutes per day (121 minutes per day/60 minutes per hour) (USEPA, 2011, Table 16-1. Recommended Values for Activity Patterns). The CT is half the RME.

References:

Ohio VAP, 2016: Support Document for the Development of Generic Numerical Standards and Risk Assessment Procedures, Table 4: Summary of all scenario and receptor-specific parameters, May 2016.
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A OERR. EPA/540-1-89-002.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Emergency and Remedial Response, OSWER 9355.4-24, December 2002.
USEPA, 2004: RAGs Volume 1, Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.
USEPA, 2005: Guidelines for Carcinogenic Risk Assessment and Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, March 2005.
USEPA, 2011: Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, September 2011.
USEPA, 2012: Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil, OSWER 9200.1-113, December 2012.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.
USEPA, 2019: Regional Screening Level User's Guide, May 2019 (http://www.epa.gov/reg3hwmd/risk/human/rb-concentration_table/usersguide.htm).

Table 4.4

Derivation of Volatilization Factor (VF) for Surface Soil - Resident and Recreation User Inhalation Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Input Parameters			Reference	Units	1,1-Dichloroethane		Trichloroethene		Vinyl chloride		Benzo(a)anthracene		Naphthalene		Pyrene		Cyanide (total)		Mercury	
					CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME
VF: Soil-to-Air Volatilization Factor																				
$VF = Q/C \times \frac{(3.14 \times D_A \times T)^{1/2}}{(2 \times \rho_b \times D_A)} \times 10^{-4} (m^2/cm^2)$																				
Where:	**VF**	=	**soil-to-air volatilization factor**	Equation 4-8, USEPA, 2002	m³/kg	**1.5E+03**	**2.6E+03**	**1.6E+03**	**2.8E+03**	**7.1E+02**	**1.2E+03**	**3.3E+06**	**5.5E+06**	**3.4E+04**	**5.8E+04**	**1.8E+06**	**3.0E+06**	**3.9E+04**	**6.7E+04**	**2.6E+04**	**4.4E+04**
	Q/C_{vol}	=	inverse of mean conc - centre of square source	Equation D-3, USEPA, 2002	(g/m²-sec)/(kg/m³)	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01
	D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	3.1E-03	3.1E-03	2.7E-03	2.7E-03	1.5E-02	1.5E-02	6.8E-10	6.8E-10	6.2E-06	6.2E-06	2.3E-09	2.3E-09	4.7E-06	4.7E-06	1.1E-05	1.1E-05
	T	=	exposure interval	USEPA, 2002	s	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08
	r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
Q/C_{vol}: Inverse of Mean Conc - Centre of Square Source																				
$Q/C_{vol} = A \times \exp\frac{(\ln Area - B)^2}{C}$																				
Where:	"A"	=	constant	USEPA, 2002 (1)	unitless	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01
	Area	=	areal extent of the site or contamination	USEPA, 2002	acres	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01
	"B"	=	constant	USEPA, 2002 (1)	unitless	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01
	"C"	=	constant	USEPA, 2002 (1)	unitless	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02
D_A: Apparent Diffusivity																				
$D_A = \frac{\left[\left(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w\right)/n^2\right]}{\rho_b K_b + \Theta_w + \Theta_a H'}$																				
Where:	D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	3.1E-03	3.1E-03	2.7E-03	2.7E-03	1.5E-02	1.5E-02	6.8E-10	6.8E-10	6.2E-06	6.2E-06	2.3E-09	2.3E-09	4.7E-06	4.7E-06	1.1E-05	1.1E-05
	Q_a	=	air-filled porosity	USEPA, 2002	unitless	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01
	Q_w	=	water-filled porosity	USEPA, 2002	unitless	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
	n	=	total soil porosity	USEPA, 2002	unitless	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
	r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
	H'	=	dimensionless Henry's Law Constant	RSL, 2019	unitless	2.3E-01	2.3E-01	4.0E-01	4.0E-01	1.1E+00	1.1E+00	4.9E-04	4.9E-04	1.8E-02	1.8E-02	4.9E-04	4.9E-04	4.2E-03	4.2E-03	3.5E-01	3.5E-01
	D_i	=	diffusivity of chemical x in air	RSL, 2019	cm²/s	8.4E-02	8.4E-02	6.9E-02	6.9E-02	1.1E-01	1.1E-01	2.6E-02	2.6E-02	6.0E-02	6.0E-02	2.8E-02	2.8E-02	2.1E-01	2.1E-01	3.1E-02	3.1E-02
	D_w	=	diffusivity of chemical x in water	RSL, 2019	cm²/s	1.1E-05	1.1E-05	1.0E-05	1.0E-05	1.2E-05	1.2E-05	6.7E-06	6.7E-06	8.4E-06	8.4E-06	7.2E-06	7.2E-06	2.5E-05	2.5E-05	6.3E-06	6.3E-06
	K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	1.9E-01	1.9E-01	3.6E-01	3.6E-01	1.3E-01	1.3E-01	1.1E+03	1.1E+03	9.3E+00	9.3E+00	3.3E+02	3.3E+02	9.9E+00	9.9E+00	5.2E+01	5.2E+01
Kd: Soil-Water Partition Coefficient																				
$K_d = K_{oc} \times f_{oc}$																				
Where:	K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	1.9E-01	1.9E-01	3.6E-01	3.6E-01	1.3E-01	1.3E-01	1.1E+03	1.1E+03	9.3E+00	9.3E+00	3.3E+02	3.3E+02	9.9E+00	9.9E+00	5.2E+01	5.2E+01
	K_{oc}	=	soil organic carbon-water partition coefficient	RSL, 2019	cm³/g	3.2E+01	3.2E+01	6.1E+01	6.1E+01	2.2E+01	2.2E+01	1.8E+05	1.8E+05	1.5E+03	1.5E+03	5.4E+04	5.4E+04	--	--	--	--
	f_{oc}	=	organic content of soil	USEPA, 2002	g/g	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03

Notes:

(1) Refer to Exhibit D-3, Values for the constants (A, B, and C) for Calculating Q/C_{vol}, Zone 7, Cleveland, OH.

References:

Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April 2019.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.

Table 4.4

Derivation of Volatilization Factor (VF) for Surface Soil - Resident and Recreation User Inhalation Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Input Parameters			Reference	Units	Aroclor-1232 (PCB-1232)		Aroclor-1242 (PCB-1242)		Aroclor-1248 (PCB-1248)		Aroclor-1254 (PCB-1254)		Aroclor-1260 (PCB-1260)		Heptachlor epoxide		Total TEQ	
					CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME
VF: Soil-to-Air Volatilization Factor																		
$VF = Q/C \times \frac{(3.14 \times D_A \times T)^{1/2}}{(2 \times \rho_b \times D_A)} \times 10^{-4} (m^2/cm^2)$																		
Where:	**VF**	=	**soil-to-air volatilization factor**	Equation 4-8, USEPA, 2002	m³/kg	**8.3E+04**	**1.4E+05**	**4.4E+05**	**7.4E+05**	**4.6E+05**	**7.9E+05**	**6.2E+05**	**1.1E+06**	**9.7E+05**	**1.7E+06**	**6.2E+05**	**1.1E+06**	**1.4E+06**	**2.5E+06**
	Q/C_{vol}	=	inverse of mean conc - centre of square source	Equation D-3, USEPA, 2002	(g/m²-sec)/(kg/m³)	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01
	D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	1.1E-06	1.1E-06	3.8E-08	3.8E-08	3.4E-08	3.4E-08	1.9E-08	1.9E-08	7.7E-09	7.7E-09	1.9E-08	1.9E-08	3.5E-09	3.5E-09
	T	=	exposure interval	USEPA, 2002	s	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08	2.8E+08	8.2E+08
	r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
Q/C_{vol}: Inverse of Mean Conc - Centre of Square Source																		
$Q/C_{vol} = A \times \exp \frac{(\ln Area - B)^2}{C}$																		
Where:	"A"	=	constant	USEPA, 2002 (1)	unitless	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01
	Area	=	areal extent of the site or contamination	USEPA, 2002	acres	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01
	"B"	=	constant	USEPA, 2002 (1)	unitless	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01
	"C"	=	constant	USEPA, 2002 (1)	unitless	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02
D_A: Apparent Diffusivity																		
$D_A = \frac{\left[\left(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w\right)/n^2\right]}{\rho_b K_b + \Theta_w + \Theta_a H'}$																		
Where:	D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	1.1E-06	1.1E-06	3.8E-08	3.8E-08	3.4E-08	3.4E-08	1.9E-08	1.9E-08	7.7E-09	7.7E-09	1.9E-08	1.9E-08	3.5E-09	3.5E-09
	Q_a	=	air-filled porosity	USEPA, 2002	unitless	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01
	Q_w	=	water-filled porosity	USEPA, 2002	unitless	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
	n	=	total soil porosity	USEPA, 2002	unitless	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
	r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
	H'	=	dimensionless Henry's Law Constant	RSL, 2019	unitless	3.0E-02	3.0E-02	1.4E-02	1.4E-02	1.8E-02	1.8E-02	1.2E-02	1.2E-02	1.4E-02	1.4E-02	8.6E-04	8.6E-04	2.0E-03	2.0E-03
	D_i	=	diffusivity of chemical x in air	RSL, 2019	cm²/s	3.3E-02	3.3E-02	2.4E-02	2.4E-02	1.6E-02	1.6E-02	2.4E-02	2.4E-02	2.2E-02	2.2E-02	2.4E-02	2.4E-02	4.7E-02	4.7E-02
	D_w	=	diffusivity of chemical x in water	RSL, 2019	cm²/s	7.5E-06	7.5E-06	6.1E-06	6.1E-06	3.9E-06	3.9E-06	6.1E-06	6.1E-06	5.6E-06	5.6E-06	6.2E-06	6.2E-06	6.8E-06	6.8E-06
	K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	5.0E+01	5.0E+01	4.7E+02	4.7E+02	4.6E+02	4.6E+02	7.8E+02	7.8E+02	2.1E+03	2.1E+03	6.1E+01	6.1E+01	1.5E+03	1.5E+03
Kd: Soil-Water Partition Coefficient																		
$K_d = K_{oc} \times f_{oc}$																		
Where:	K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	5.0E+01	5.0E+01	4.7E+02	4.7E+02	4.6E+02	4.6E+02	7.8E+02	7.8E+02	2.1E+03	2.1E+03	6.1E+01	6.1E+01	1.5E+03	1.5E+03
	K_{oc}	=	soil organic carbon-water partition coefficient	RSL, 2019	cm³/g	8.4E+03	8.4E+03	7.8E+04	7.8E+04	7.7E+04	7.7E+04	1.3E+05	1.3E+05	3.5E+05	3.5E+05	1.0E+04	1.0E+04	2.5E+05	2.5E+05
	f_{oc}	=	organic content of soil	USEPA, 2002	g/g	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03

Notes:

(1) Refer to Exhibit D-3, Values for the constants (A, B, and C) for Calculating Q/C_{vol}, Zone 7, Cleveland, OH.

References:

Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April 2019.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.

Table 4.5

Values Used for Daily Intake Calculations - Industrial/Commercial Worker Exposure to Surface Soil and Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Soil (0-2 ft BGS)/Soil (0-15 ft BGS)
Exposure Medium: Surface Soil/Soil
Receptor Population: Industrial/Commercial Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR	Ingestion Rate of Soil	mg soil/ day	100	USEPA, 2014	100	USEPA, 2014	CS x IR x CF x ABS x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	
	EF	Exposure Frequency	days/year	250	USEPA, 2014	219	USEPA, 2004	
	ED	Exposure Duration	years	25	USEPA, 2014	9	USEPA, 2004	
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	9,125	USEPA, 1989	3,285	USEPA, 1989	
	ABS	Absorption Factor	%/100	chemical-specific	USEPA, 2012 (2)	chemical-specific	USEPA, 2012 (2)	
Dermal	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2	3,527	USEPA, 2014	3,527	USEPA, 2014	CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	
	EF	Exposure Frequency	days/year	250	USEPA, 2014	219	USEPA, 2004	
	ED	Exposure Duration	years	25	USEPA, 2014	9	USEPA, 2004	
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	9,125	USEPA, 1989	3,285	USEPA, 1989	
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.12	USEPA, 2014	0.02	USEPA, 2004	
	ABS	Absorption Factor	%/100	chemical-specific	(3)	chemical-specific	(3)	

Table 4.5

Values Used for Daily Intake Calculations - Industrial/Commercial Worker Exposure to Surface Soil and Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Soil (0-2 ft BGS)/Soil (0-15 ft BGS)
Exposure Medium: Surface Soil/Soil
Receptor Population: Industrial/Commercial Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Exposure Concentration (EC) (mg/m^3) =
	ET	Exposure Time	unitless	8/24	USEPA, 2014	8/24	USEPA, 2014	CS x ET x EF x ED x 1/(PEF + VF) x 1/AT
	EF	Exposure Frequency	days/year	250	USEPA, 2014	219	USEPA, 2004	
	ED	Exposure Duration	years	25	USEPA, 2014	9	USEPA, 2004	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	9,125	USEPA, 1989	3,285	USEPA, 1989	
	PEF	Particulate Emission Factor	m^3/kg	1.36E+09	USEPA, 2002	1.36E+09	USEPA, 2002	
	VF	Volatilization Factor	m^3/kg	chemical-specific	Refer to Table 4.6	chemical-specific	Refer to Table 4.6	

Notes:

(1) For surface soil and soil concentrations, refer to each exposure unit (EU) for EPCs.
(2) Current default assumption of 100% with the exception of arsenic at 60%.
(3) USEPA 2004 Exhibit 3-4 and metals of 1% as recommeded by Region 3 Technical Guidance Manual, Risk Assessment https://www.epa.gov/risk/assessing-dermal-exposure-soil

References:

USEPA, 1989: Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund (RAGS):Volume 1 - Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005, July 2004.
USEPA, 2012: Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil, OSWER 9200.1-113, December 2012.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

Table 4.6

Derivation of Volatilization Factor (VF) for Surface Soil and Soil - Industrial/Commercial Worker and Maintenance Worker Inhalation Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Input Parameters			Reference	Units	1,1-Dichloroethane		Trichloroethene		Vinyl chloride		Benzo(a)anthracene		Naphthalene		Pyrene		Cyanide (total)		Mercury	
					CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME
VF: Soil-to-Air Volatilization Factor																				
$VF = Q/C \times \frac{(3.14 \times D_A \times T)^{1/2}}{(2 \times \rho_b \times D_A)} \times 10^{-4} (m^2/cm^2)$																				
Where:	**VF**	=	**soil-to-air volatilization factor**	m³/kg	**1.5E+03**	**2.6E+03**	**1.6E+03**	**2.7E+03**	**7.1E+02**	**1.2E+03**	**3.3E+06**	**5.4E+06**	**3.4E+04**	**5.7E+04**	**1.8E+06**	**2.9E+06**	**3.9E+04**	**6.6E+04**	**2.6E+04**	**4.3E+04**
	Q/C_{vol}	=	inverse of mean conc - centre of square source	(g/m²-sec)/(kg/m³)	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01
	D_A	=	apparent diffusivity	cm²/s	3.1E-03	3.1E-03	2.7E-03	2.7E-03	1.5E-02	1.5E-02	6.8E-10	6.8E-10	6.2E-06	6.2E-06	2.3E-09	2.3E-09	4.7E-06	4.7E-06	1.1E-05	1.1E-05
	T	=	exposure interval	s	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08
	r_b	=	soil dry bulk density	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
Q/C_{vol}: Inverse of Mean Conc - Centre of Square Source																				
$Q/C_{vol} = A \times \exp \frac{(\ln Area - B)^2}{C}$																				
Where:	"A"	=	constant	unitless	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01
	Area	=	areal extent of the site or contamination	acres	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01
	"B"	=	constant	unitless	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01
	"C"	=	constant	unitless	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02
D_A: Apparent Diffusivity																				
$D_A = \frac{\left[\left(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w\right)/n^2\right]}{\rho_b K_b + \Theta_w + \Theta_a H'}$																				
Where:	D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	3.1E-03	3.1E-03	2.7E-03	2.7E-03	1.5E-02	1.5E-02	6.8E-10	6.8E-10	6.2E-06	6.2E-06	2.3E-09	2.3E-09	4.7E-06	4.7E-06	1.1E-05	1.1E-05
	Q_a	=	air-filled porosity	USEPA, 2002	unitless	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01
	Q_w	=	water-filled porosity	USEPA, 2002	unitless	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
	n	=	total soil porosity	USEPA, 2002	unitless	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
	r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
	H'	=	dimensionless Henry's Law Constant	RSL, 2019	unitless	2.3E-01	2.3E-01	4.0E-01	4.0E-01	1.1E+00	1.1E+00	4.9E-04	4.9E-04	1.8E-02	1.8E-02	4.9E-04	4.9E-04	4.2E-03	4.2E-03	3.5E-01	3.5E-01
	D_i	=	diffusivity of chemical x in air	RSL, 2019	cm²/s	8.4E-02	8.4E-02	6.9E-02	6.9E-02	1.1E-01	1.1E-01	2.6E-02	2.6E-02	6.0E-02	6.0E-02	2.8E-02	2.8E-02	2.1E-01	2.1E-01	3.1E-02	3.1E-02
	D_w	=	diffusivity of chemical x in water	RSL, 2019	cm²/s	1.1E-05	1.1E-05	1.0E-05	1.0E-05	1.2E-05	1.2E-05	6.7E-06	6.7E-06	8.4E-06	8.4E-06	7.2E-06	7.2E-06	2.5E-05	2.5E-05	6.3E-06	6.3E-06
	K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	1.9E-01	1.9E-01	3.6E-01	3.6E-01	1.3E-01	1.3E-01	1.1E+03	1.1E+03	9.3E+00	9.3E+00	3.3E+02	3.3E+02	9.9E+00	9.9E+00	5.2E+01	5.2E+01
Kd: Soil-Water Partition Coefficient																				
$K_d = K_{oc} \times f_{oc}$																				
Where:	K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	1.9E-01	1.9E-01	3.6E-01	3.6E-01	1.3E-01	1.3E-01	1.1E+03	1.1E+03	9.3E+00	9.3E+00	3.3E+02	3.3E+02	9.9E+00	9.9E+00	5.2E+01	5.2E+01
	K_{oc}	=	soil organic carbon-water partition coefficient	RSL, 2019	cm³/g	3.2E+01	3.2E+01	6.1E+01	6.1E+01	2.2E+01	2.2E+01	1.8E+05	1.8E+05	1.5E+03	1.5E+03	5.4E+04	5.4E+04	--	--	--	--
	f_{oc}	=	organic content of soil	USEPA, 2002	g/g	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03

Notes:

(1) Refer to Exhibit D-3, Values for the constants (A, B, and C) for Calculating Q/C_{vol}, Zone 7, Cleveland, OH.

References:

Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April 2019.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.

Table 4.6

Derivation of Volatilization Factor (VF) for Surface Soil and Soil - Industrial/Commercial Worker and Maintenance Worker Inhalation Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Input Parameters			Reference	Units	Aroclor-1232 (PCB-1232)		Aroclor-1242 (PCB-1242)		Aroclor-1248 (PCB-1248)		Aroclor-1254 (PCB-1254)		Aroclor-1260 (PCB-1260)		Heptachlor epoxide		Total TEQ	
					CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME	CT	RME
VF: Soil-to-Air Volatilization Factor																		
$VF = Q/C \times \frac{(3.14 \times D_A \times T)^{1/2}}{(2 \times \rho_b \times D_A)} \times 10^{-4} (m^2/cm^2)$																		
Where: **VF**	=	**soil-to-air volatilization factor**	Equation 4-8, USEPA, 2002	m³/kg	**8.3E+04**	**1.4E+05**	**4.4E+05**	**7.3E+05**	**4.6E+05**	**7.7E+05**	**6.2E+05**	**1.0E+06**	**9.7E+05**	**1.6E+06**	**6.2E+05**	**1.0E+06**	**1.4E+06**	**2.4E+06**
Q/C_{vol}	=	inverse of mean conc - centre of square source	Equation D-3, USEPA, 2002	(g/m²-sec)/(kg/m³)	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01	8.6E+01
D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	1.1E-06	1.1E-06	3.8E-08	3.8E-08	3.4E-08	3.4E-08	1.9E-08	1.9E-08	7.7E-09	7.7E-09	1.9E-08	1.9E-08	3.5E-09	3.5E-09
T	=	exposure interval	USEPA, 2002	s	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08	2.8E+08	7.9E+08
r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
Q/C_{vol}: Inverse of Mean Conc - Centre of Square Source																		
$Q/C_{vol} = A \times \exp \frac{(\ln Area - B)^2}{C}$																		
Where: "A"	=	constant	USEPA, 2002 (1)	unitless	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01	1.3E+01
Area	=	areal extent of the site or contamination	USEPA, 2002	acres	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01
"B"	=	constant	USEPA, 2002 (1)	unitless	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01	2.1E+01
"C"	=	constant	USEPA, 2002 (1)	unitless	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02	2.4E+02
D_A: Apparent Diffusivity																		
$D_A = \frac{\left[\left(\Theta_a^{10/3} D_i H' + \Theta_w^{10/3} D_w\right)/n^2\right]}{\rho_b K_b + \Theta_w + \Theta_a H'}$																		
Where: D_A	=	apparent diffusivity	Equation 4-8, USEPA, 2002	cm²/s	1.1E-06	1.1E-06	3.8E-08	3.8E-08	3.4E-08	3.4E-08	1.9E-08	1.9E-08	7.7E-09	7.7E-09	1.9E-08	1.9E-08	3.5E-09	3.5E-09
Q_a	=	air-filled porosity	USEPA, 2002	unitless	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01
Q_w	=	water-filled porosity	USEPA, 2002	unitless	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
n	=	total soil porosity	USEPA, 2002	unitless	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
r_b	=	soil dry bulk density	USEPA, 2002	g/cm³	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
H'	=	dimensionless Henry's Law Constant	RSL, 2019	unitless	3.0E-02	3.0E-02	1.4E-02	1.4E-02	1.8E-02	1.8E-02	1.2E-02	1.2E-02	1.4E-02	1.4E-02	8.6E-04	8.6E-04	2.0E-03	2.0E-03
D_i	=	diffusivity of chemical x in air	RSL, 2019	cm²/s	3.3E-02	3.3E-02	2.4E-02	2.4E-02	1.6E-02	1.6E-02	2.4E-02	2.4E-02	2.2E-02	2.2E-02	2.4E-02	2.4E-02	4.7E-02	4.7E-02
D_w	=	diffusivity of chemical x in water	RSL, 2019	cm²/s	7.5E-06	7.5E-06	6.1E-06	6.1E-06	3.9E-06	3.9E-06	6.1E-06	6.1E-06	5.6E-06	5.6E-06	6.2E-06	6.2E-06	6.8E-06	6.8E-06
K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	5.0E+01	5.0E+01	4.7E+02	4.7E+02	4.6E+02	4.6E+02	7.8E+02	7.8E+02	2.1E+03	2.1E+03	6.1E+01	6.1E+01	1.5E+03	1.5E+03
Kd: Soil-Water Partition Coefficient																		
$K_d = K_{oc} \times f_{oc}$																		
Where: K_d	=	soil-water partition coefficient	USEPA, 2002	cm³/g	5.0E+01	5.0E+01	4.7E+02	4.7E+02	4.6E+02	4.6E+02	7.8E+02	7.8E+02	2.1E+03	2.1E+03	6.1E+01	6.1E+01	1.5E+03	1.5E+03
K_{oc}	=	soil organic carbon-water partition coefficient	RSL, 2019	cm³/g	8.4E+03	8.4E+03	7.8E+04	7.8E+04	7.7E+04	7.7E+04	1.3E+05	1.3E+05	3.5E+05	3.5E+05	1.0E+04	1.0E+04	2.5E+05	2.5E+05
f_{oc}	=	organic content of soil	USEPA, 2002	g/g	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03

Notes:

(1) Refer to Exhibit D-3, Values for the constants (A, B, and C) for Calculating Q/C_{vol}, Zone 7, Cleveland, OH.

References:

Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April 2019.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.

Table 4.7

Values Used for Daily Intake Calculations - Construction/Utility Worker Exposure to Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Soil (0-15 ft BGS)/ Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Soil
Receptor Population: Construction/Utility Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR	Ingestion Rate of Soil	mg soil/ day	330	USEPA, 2002	330	USEPA, 2002	CS x IR x CF x ABS x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	
	EF	Exposure Frequency	days/year	120	Ohio VAP, 2016	60	(2)	
	ED	Exposure Duration	years	1	USEPA, 2002	1	USEPA, 2002	
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	365	USEPA, 1989	365	USEPA, 1989	
	ABS	Absorption Factor	%/100	chemical-specific	USEPA, 2012 (3)	chemical-specific	USEPA, 2012 (3)	
Dermal	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2	3,527	USEPA, 2014	3,527	USEPA, 2014	CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	
	EF	Exposure Frequency	days/year	120	Ohio VAP, 2016	60	(2)	
	ED	Exposure Duration	years	1	USEPA, 2002	1	USEPA, 2002	
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	365	USEPA, 1989	365	USEPA, 1989	
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.3	USEPA, 2004	0.1	USEPA, 2004	
	ABS	Absorption Factor	%/100	chemical-specific	(4)	chemical-specific	(4)	

Table 4.7

Values Used for Daily Intake Calculations - Construction/Utility Worker Exposure to Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Soil (0-15 ft BGS)/ Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Soil
Receptor Population: Construction/Utility Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Exposure Concentration (EC) (mg/m^3) =
	ET	Exposure Time	unitless	8/24	USEPA, 2014	8/24	USEPA, 2014	CS x ET x EF x ED x 1/(PEF + VF) x 1/AT
	EF	Exposure Frequency	days/year	120	Ohio VAP, 2016	60	(2)	
	ED	Exposure Duration	years	1	USEPA, 2002	1	USEPA, 2002	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	365	USEPA, 1989	365	USEPA, 1989	
	PEF	Particulate Emission Factor	m^3/kg	1.34E+07	Ohio VAP, 2016	1.34E+07	Ohio VAP, 2016	
	VF	Volatilization Factor	m^3/kg	chemical-specific	Refer to Table 4.8	chemical-specific	Refer to Table 4.8	

Notes:

(1) For soil concentrations, refer to each exposure unit (EU) for EPCs. For Floodplain surface soil concentrations, refer to Table 3.40.
(2) An exposure frequency of 120 days/year for construction/excavation activities was chosen by Ohio EPA on the basis of best professional judgment (Ohio VAP Part C, p. 41). The CT is half the RME value.
(3) The default assumption of 100% is applied for all parameters with the exception of arsenic at 60%.
(4) USEPA 2004 Exhibit 3-4 and metals of 1% as recommeded by Region 3 Technical Guidance Manual, Risk Assessment https://www.epa.gov/risk/assessing-dermal-exposure-soil

References:

Ohio VAP, 2016: Suport Document for the Development of Generic Numerical Standards and Risk Assessment Procedures, Table 4: Summary of all scenario and receptor-specific parameters, May 2016.
USEPA, 1989: Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund (RAGS):Volume 1 - Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005, July 2004.
USEPA, 2012: Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil, OSWER 9200.1-113, December 2012.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

Table 4.8

Derivation of Volatilization Factor (VF) for Soil - Construction/Utility Worker Inhalation Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

$VF = (Q/C) \times 1/F_D \times ((3.14 \times D_a \times T)^{1/2}) \times 10^{-4} / (2 \times db \times D_a)$

$Da = ((Pa^{10/3} \times Di \times H + Pw^{10/3} \times Dw) / n^2)/(db \times Kd + Pw + Pa \times H)$

$Q/C_{sa} = A \times EXP [(\ln A_s - B)^2 / C]$

$F_D = 0.1852+(5.3537/t_c)+(-9.6318/t_c^2)$

Input Parameters	Reference	1,1-Dichloroethane CTE/RME	Trichloroethene CTE/RME	Vinyl chloride CTE/RME	Benzo(a)anthracene CTE/RME	Naphthalene CTE/RME	Pyrene CTE/RME	Cyanide (total) CTE/RME	Mercury CTE/RME
VF/ volatilization factor (m^3/kg) =	Equation 5-14, USEPA, 2002	**4.6E+02**	**4.9E+02**	**2.1E+02**	**9.8E+05**	**1.1E+04**	**5.3E+05**	**1.2E+04**	**7.7E+03**
Da/ apparent diffusivity (cm^2/s) =	Equation 5-14, USEPA, 2002	3.1E-03	2.7E-03	1.5E-02	6.8E-10	5.8E-06	2.3E-09	4.7E-06	1.1E-05
Q/C/ inverse of the mean conc. at center of square source (g/m^2-s per kg/m^3) =	Equation 5-15, USEPA, 2002	1.4E+01	1.4E+01	1.4E+01	1.4E+01	1.4E+01	1.4E+01	1.4E+01	1.4E+01
A/ constant (unitless) =	USEPA, 2002	2.5E+00	2.5E+00	2.5E+00	2.5E+00	2.5E+00	2.5E+00	2.5E+00	2.5E+00
B/ constant (unitless) =	USEPA, 2002	1.8E+01	1.8E+01	1.8E+01	1.8E+01	1.8E+01	1.8E+01	1.8E+01	1.8E+01
C/ constant (unitless) =	USEPA, 2002	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02
A_s/ areal extent of site surface soil contamination (acres) =	USEPA, 2002	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01
F_D/ dispersion correction factor (unitless) =	Equation E-16, USEPA, 2002	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01
Pa/ air-filled soil porosity (L_{air}/L_{soil}) =	USEPA, 2002	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01
Di/ diffusivity of chemical x in air at ref. temp. =	RSL, 2019	8.4E-02	6.9E-02	1.1E-01	2.6E-02	6.0E-02	2.8E-02	2.1E-01	3.1E-02
H/ Henry's Law Constant dimensionless at ref. temp. =	RSL, 2019	2.3E-01	4.0E-01	1.1E+00	4.9E-04	1.8E-02	4.9E-04	4.2E-03	3.5E-01
Pw/ water-filled soil porosity (L_{water}/L_{soil}) =	USEPA, 2002	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
Dw/ diffusivity of chemical x in water at ref. temp. =	RSL, 2019	1.1E-05	1.0E-05	1.2E-05	6.7E-06	8.4E-06	7.2E-06	2.5E-05	6.3E-06
n/ total soil porosity (L_{pore}/L_{soil}) =	USEPA, 2002	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
db/ dry soil bulk density (g/cm^3) =	USEPA, 2002	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
Kd/ soil-water partition coefficient (cm^3/g) =	USEPA, 2002 (Kd = Koc x foc)	1.9E-01	3.6E-01	1.3E-01	1.1E+03	9.9E+00	3.3E+02	9.9E+00	5.2E+01
Koc/ soil organic carbon-water partition coefficient (cm^3/g) =	RSL, 2019	3.2E+01	6.1E+01	2.2E+01	1.8E+05	1.5E+03	5.4E+04	--	--
foc/ organic carbon content of soil (g/g) =	USEPA, 2002	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03
t_c/ exposure interval (hrs) =	Site-Specific	8.8E+03	8.8E+03	8.8E+03	8.8E+03	8.8E+03	8.8E+03	8.8E+03	8.8E+03
T/ exposure interval (s) =	Site-Specific (within 1 yr campaign)	3.2E+07	3.2E+07	3.2E+07	3.2E+07	3.2E+07	3.2E+07	3.2E+07	3.2E+07
Conversion Factor/ 10^{-4} (m^2/cm^2) =	USEPA, 2002	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04

References:

Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April 2019.

USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.

Table 4.8

Derivation of Volatilization Factor (VF) for Soil - Construction/Utility Worker Inhalation Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

$VF = (Q/C) \times 1/F_D \times ((3.14 \times D_a \times T)^{1/2}) \times 10^{-4} / (2 \times db \times D_a)$

$Da = ((Pa^{10/3} \times Di \times H + Pw^{10/3} \times Dw) / n^2)/(db \times Kd + Pw + Pa \times H)$

$Q/C_{sa} = A \times EXP [(\ln A_s - B)^2 / C]$

$F_D = 0.1852+(5.3537/t_c)+(-9.6318/t_c^2)$

Input Parameters	Reference	Aroclor-1232 (PCB-1232) CTE/RME	Aroclor-1242 (PCB-1242) CTE/RME	Aroclor-1248 (PCB-1248) CTE/RME	Aroclor-1254 (PCB-1254) CTE/RME	Aroclor-1260 (PCB-1260) CTE/RME	Heptachlor epoxide CTE/RME	Total TEQ CTE/RME
VF/ volatilization factor (m^3/kg) =	Equation 5-14, USEPA, 2002	**2.5E+04**	**1.3E+05**	**1.4E+05**	**1.9E+05**	**2.9E+05**	**1.9E+05**	**4.3E+05**
Da/ apparent diffusivity (cm^2/s) =	Equation 5-14, USEPA, 2002	1.1E-06	3.8E-08	3.4E-08	1.9E-08	7.7E-09	1.9E-08	3.5E-09
Q/C/ inverse of the mean conc. at center of square source (g/m^2-s per kg/m^3) =	Equation 5-15, USEPA, 2002	1.4E+01	1.4E+01	1.4E+01	1.4E+01	1.4E+01	1.4E+01	1.4E+01
A/ constant (unitless) =	USEPA, 2002	2.5E+00	2.5E+00	2.5E+00	2.5E+00	2.5E+00	2.5E+00	2.5E+00
B/ constant (unitless) =	USEPA, 2002	1.8E+01	1.8E+01	1.8E+01	1.8E+01	1.8E+01	1.8E+01	1.8E+01
C/ constant (unitless) =	USEPA, 2002	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02	1.9E+02
A_s/ areal extent of site surface soil contamination (acres) =	USEPA, 2002	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01	5.0E-01
F_D/ dispersion correction factor (unitless) =	Equation E-16, USEPA, 2002	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01	1.9E-01
Pa/ air-filled soil porosity (L_{air}/L_{soil}) =	USEPA, 2002	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01	2.8E-01
Di/ diffusivity of chemical x in air at ref. temp. =	RSL, 2019	3.3E-02	2.4E-02	1.6E-02	2.4E-02	2.2E-02	2.4E-02	4.7E-02
H/ Henry's Law Constant dimensionless at ref. temp. =	RSL, 2019	3.0E-02	1.4E-02	1.8E-02	1.2E-02	1.4E-02	8.6E-04	2.0E-03
Pw/ water-filled soil porosity (L_{water}/L_{soil}) =	USEPA, 2002	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01	1.5E-01
Dw/ diffusivity of chemical x in water at ref. temp. =	RSL, 2019	7.5E-06	6.1E-06	3.9E-06	6.1E-06	5.6E-06	6.2E-06	6.8E-06
n/ total soil porosity (L_{pore}/L_{soil}) =	USEPA, 2002	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01	4.3E-01
db/ dry soil bulk density (g/cm^3) =	USEPA, 2002	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00	1.5E+00
Kd/ soil-water partition coefficient (cm^3/g) =	USEPA, 2002 (Kd = Koc x foc)	5.0E+01	4.7E+02	4.6E+02	7.8E+02	2.1E+03	6.1E+01	1.5E+03
Koc/ soil organic carbon-water partition coefficient (cm^3/g) =	RSL, 2019	8.4E+03	7.8E+04	7.7E+04	1.3E+05	3.5E+05	1.0E+04	2.5E+05
foc/ organic carbon content of soil (g/g) =	USEPA, 2002	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03	6.0E-03
t_c/ exposure interval (hrs) =	Site-Specific	8.8E+03	8.8E+03	8.8E+03	8.8E+03	8.8E+03	8.8E+03	8.8E+03
T/ exposure interval (s) =	Site-Specific (within 1 yr campaign)	3.2E+07	3.2E+07	3.2E+07	3.2E+07	3.2E+07	3.2E+07	3.2E+07
Conversion Factor/ 10^{-4} (m^2/cm^2) =	USEPA, 2002	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04	1.0E-04

References:

Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April 2019.

USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.

Table 4.9

Values Used for Daily Intake Calculations - Indoor Worker Exposure to Indoor Air
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Soil Vapor/ Groundwater
Exposure Medium: Indoor Air
Receptor Population: Indoor Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CIA	Chemical Concentration in Indoor Air	mg/m3	(1)	(1)	(2)	(2)	Exposure Concentration (EC) (mg/m^3) =
	FT	Fraction Time Exposed	unitless	8/24	USEPA, 2014	8/24	USEPA, 2014	CIA x FT x EF x ED x 1/AT
	EF	Exposure Frequency	days/year	250	USEPA, 2004	219	USEPA, 2004	
	ED	Exposure Duration	years	25	USEPA, 2004	9	USEPA, 2004	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	9,125	USEPA, 1989	3,285	USEPA, 1989	

Notes:

(1) For indoor air concentrations modeled from soil vapor and groundwater, refer to Appendix C.

References:

USEPA, 1989: Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989.
USEPA, 2004: Risk Assessment Guidance for Superfund (RAGS):Volume 1 - Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005, July 2004.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER 9200.1-120, February 6, 2014.

Table 4.10

Values Used for Daily Intake Calculations - Resident Exposure to Tapwater (Household Use) and Indoor Air
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater
Exposure Medium: Tapwater (Household Use)/Indoor Air
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Groundwater	mg/L	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR - child	Ingestion Rate of Water	L/day	0.78	USEPA, 2014	0.78	USEPA, 2014	CW x IR x EF x ED x 1/BW x 1/AT
	IR - adult	Ingestion Rate of Water	L/day	2.5	USEPA, 2014	2.5	USEPA, 2014	
	IFWMadj	Mutagenic Ingestion Rate - Age-adjusted	L-year/kg-event	3.0	USEPA, 2005 (2)	1.9	USEPA, 2005 (2)	Mutagenic CDI (mg/kg-day) =
	EF	Exposure Frequency	days/year	350	USEPA, 2004	350	USEPA, 2004	CW x IFWMadj x EF x 1/AT-C
	ED - child	Exposure Duration	years	6	USEPA, 2004	6	USEPA, 2004	
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	where IFWMadj =
	BW - child	Body Weight	kg	15	USEPA, 2002	15	USEPA, 2002	(ED0-2 x IR-child x 10 / BW-child) + (ED2-6 x IR-child x 3 / BW-child) +
	BW - adult	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	(ED6-16 x IR-adult x 3 / BW-adult) + (ED16-30 x IR-adult x 1 / BW-adult)
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N (child)	Averaging Time (non-cancer) (ED-child x 365 days/year)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	TCE CDI (mg/kg-day) =
	AT-N (adult)	Averaging Time (non-cancer) (ED-adult x 365 days/year)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	CW x [(CAF x TCE IFWadj) + (MAF x TCE IFWMadj)] x 1/AT-C
	CAF	TCE Cancer Adjustment Factor	unitless	0.804	USEPA, 2019 (3)	0.804	USEPA, 2019 (3)	
	MAF	TCE Mutagenic Adjust Factor	Unitless	0.202	USEPA, 2019 (3)	0.202	USEPA, 2019 (3)	where TCE IFWadj =
	TCE IFWadj	TCE Ingestion Rate - Toxicity-adjusted	L-year/kg-event	328	USEPA, 2019 (2)	142	USEPA, 2019 (2)	(ED0-2 x IR-child x EF / BW-child) + (ED2-6 x IR-child x EF / BW-child) +
	TCE IFWMadj	TCE Mutagenic Ingestion Rate - Age-adjusted	L-year/kg-event	1,020	USEPA, 2019 (2)	681	USEPA, 2019 (2)	(ED6-16 x IR-adult x EF / BW-adult) + (ED16-30 x IR-adult x EF / BW-adult)
								where TCE IFWMadj =
								(ED0-2 x IR-child x EF x 10 / BW-child) + (ED2-6 x IR-child x EF x 3 / BW-child) +
								(ED6-16 x IR-adult x EF x 3 / BW-adult) + (ED16-30 x IR-adult x EF x 1 / BW-adult)

Table 4.10

Values Used for Daily Intake Calculations - Resident Exposure to Tapwater (Household Use) and Indoor Air
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater
Exposure Medium: Tapwater (Household Use)/Indoor Air
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Dermal	CW	Chemical Concentration in Groundwater	mg/L	(1)	(1)	(1)	(1)	CDI (mg/kg-day) =
	SA - child	Skin Surface Area Available for Contact	cm^2	6,378	USEPA, 2014	6,378	USEPA, 2014	DAevent x SA x EF x EV x ED x 1/BW x 1/AT
	SA - adult	Skin Surface Area Available for Contact	cm^2	20,900	USEPA, 2014	20,900	USEPA, 2014	
	DFWMadj	Mutagenic dermal contact factor - Age-adjusted	cm^2-year/kg	25,101	USEPA, 2005 (2)	15,958	USEPA, 2005 (2)	Mutagenic CDI (mg/kg-day) =
	CF	Conversion Factor	L/cm^3	0.001	--	0.001	--	DAevent x DFWMadj x EF x EV x 1/AT-C
	EV	Event Frequency	event/day	1	USEPA, 2004	1	USEPA, 2004	
	ET - child	Exposure Time	hour/event	0.54	USEPA, 2014	0.33	USEPA, 2004	
	ET - adult	Exposure Time	hour/event	0.71	USEPA, 2014	0.25	USEPA, 2004	where DFWMadj =
	ETWMadj	Mutagenic exposure time - Age-adjusted	hr/day	0.78	USEPA, 2005 (2)	0.30	USEPA, 2005 (2)	$(ED_{0-2}$ x SA-child x 10 / BW-child) + $(ED_{2-6}$ x SA-child x 3 / BW-child) +
	EF	Exposure Frequency	days/year	350	USEPA, 2004	350	USEPA, 2004	$(ED_{6-16}$ x SA-adult x 3 / BW-adult) + $(ED_{16-30}$ x SA-adult x 1 / BW-adult)
	ED - child	Exposure Duration	years	6	USEPA, 2004	6	USEPA, 2004	
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	where ETWMadj =
	BW - child	Body Weight	kg	15	USEPA, 2002	15	USEPA, 2002	((ED-child x ET-child) + (ED-adult x ET-adult))/(ED-child + ED-adult)
	BW - adult	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	DAevent (mg/cm^2-event) - Organics=
	AT-N (child)	Averaging Time (non-cancer) (ED-child x 365 days/year)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	ET <= t* =
	AT-N (adult)	Averaging Time (non-cancer) (ED-adult x 365 days/year)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	2 x FA x PC x CW x CF x SQRT(6 x t_{event} x ET / PI)
	PC	Permeability Constant	cm/hr	chemical-specific	Refer to Table 4.11	chemical-specific	Refer to Table 4.11	ET > t* =
	FA	Fraction Absorbed	dimensionless	chemical-specific	Refer to Table 4.11	chemical-specific	Refer to Table 4.11	FA x PC x CW x CF x (ET/(1+B)+2 x t_{event} x $((1+3B+3B^2)/(1+B)^2)$
	t_{event}	Lag Time	hr/event	chemical-specific	Refer to Table 4.11	chemical-specific	Refer to Table 4.11	t* =2.4 x t_{event}
	B	Constant	dimensionless	chemical-specific	Refer to Table 4.11	chemical-specific	Refer to Table 4.11	
	CAF	TCE Cancer Adjustment Factor	unitless	0.804	USEPA, 2019 (3)	0.804	USEPA, 2019 (3)	Mutagenic DAevent (cm/event) - Organics=
	MAF	TCE Mutagenic Adjust Factor	Unitless	0.202	USEPA, 2019 (3)	0.202	USEPA, 2019 (3)	ETWMadj <= t* =
	TCE DFWadj	TCE dermal contact factor - Toxicity-adjusted	cm^2-year/kg	2,721,670	USEPA, 2019 (2)	1,167,233	USEPA, 2019 (2)	2 x FA x PC x CW x CF x SQRT(6 x t_{event} x ETWMadj / PI)
	TCE DFWMadj	TCE Mutagenic dermal contact factor - Age-adjusted	cm^2-year/kg	8,419,740	USEPA, 2019 (2)	5,585,178	USEPA, 2019 (2)	ETWMadj > t* =
								FA x PC x CW x CF x (ETWMadj/(1+B)+2 x t_{event} x $((1+3B+3B^2)/(1+B)^2)$
								TCE CDI (mg/kg-day) =
								DAevent x [(CAF x TCE DFWadj) + (MAF x TCE DFWMadj)] x 1/AT-C
								where DFWadj =
								$(ED_{0-2}$ x SA-child x EF / BW-child) + $(ED_{2-6}$ x SA-child x EF / BW-child) +
								$(ED_{6-16}$ x SA-adult x EF / BW-adult) + $(ED_{16-30}$ x SA-adult x EF / BW-adult)
								where DFWMadj =
								$(ED_{0-2}$ x SA-child x EF x 10 / BW-child) + $(ED_{2-6}$ x SA-child x EF x 3 / BW-child) +
								$(ED_{6-16}$ x SA-adult x EF x 3 / BW-adult) + $(ED_{16-30}$ x SA-adult x EF x 1 / BW-adult)

Table 4.10

Values Used for Daily Intake Calculations - Resident Exposure to Tapwater (Household Use) and Indoor Air
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater
Exposure Medium: Tapwater (Household Use)/Indoor Air
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation (household use)	CW	Chemical Concentration in Groundwater	mg/L	(1)	(1)	(1)	(1)	Exposure Concentration (EC) (mg/m^3) =
	FT	Fraction of Time Exposed	unitless	24/24	USEPA, 2014	24/24	USEPA, 2014	CW x FT x EF x ED x VF x 1/AT
	IFMadj	Mutagenic inhalation factor - Age-adjusted	years	72	USEPA, 2005 (2)	41	USEPA, 2005 (2)	
	EF	Exposure Frequency	days/year	350	USEPA, 2004	350	USEPA, 2004	Mutagenic EC (mg/m^3) =
	ED - child	Exposure Duration	years	6	USEPA, 2004	6	USEPA, 2004	CW x FT x EF x IFMadj x VF x 1/AT-C
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	where IFMadj =
	AT-N (child)	Averaging Time (non-cancer) (ED-child x 365 days/year)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	$(ED_{0\text{-}2} \times 10) + (ED_{2\text{-}6} \times 3) + (ED_{6\text{-}16} \times 3) + (ED_{16\text{-}30} \times 1)$
	AT-N (adult)	Averaging Time (non-cancer) (ED-adult x 365 days/year)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	
	VF	Volatilization Factor	L/m^3	0.0005 x 1000	USEPA, 1991	0.0005 x 1000	USEPA, 1991	
	CAF	TCE Cancer Adjustment Factor	unitless	0.756	USEPA, 2019 (3)	0.756	USEPA, 2019 (3)	TCE EC (mg/m^3) =
	MAF	TCE Mutagenic Adjust Factor	Unitless	0.244	USEPA, 2019 (3)	0.244	USEPA, 2019 (3)	CW x VF x 1/AT x
								[(EF x (EDc + EDa) x FT x CAF) +
								((ED0-2 x ET x EF x MAF x 10) + (ED2-6 x ET x EF x MAF x 3) +
								(ED6-16 x ET x EF x MAF x 3) + (ED16-30 x ET x EF x MAF x 1))]

Table 4.10

Values Used for Daily Intake Calculations - Resident Exposure to Tapwater (Household Use) and Indoor Air
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater
Exposure Medium: Tapwater (Household Use)/Indoor Air
Receptor Population: Resident
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CIA	Chemical Concentration in Indoor Air	mg/L	(4)	(4)	(4)	(4)	EC (mg/m^3) =
(indoor air)	FT	Fraction Time Exposed	unitless	24/24	USEPA, 2014	24/24	USEPA, 2014	CIA x FT x EF x ED x 1/AT
	IFMadj	Mutagenic inhalation factor - Age-adjusted	years	72	USEPA, 2005 (2)	41	USEPA, 2005 (2)	
	EF	Exposure Frequency	days/year	350	USEPA, 2004	350	USEPA, 2004	Mutagenic EC (mg/m^3) =
	ED - child	Exposure Duration	years	6	USEPA, 2004	6	USEPA, 2004	CIA x FT x EF x IFMadj x 1/AT
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	where IFMadj =
	AT-N (child)	Averaging Time (non-cancer) (ED-child x 365 days/year)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	$(ED_{0\text{-}2} \times 10) + (ED_{2\text{-}6} \times 3) + (ED_{6\text{-}16} \times 3) + (ED_{16\text{-}30} \times 1)$
	AT-N (adult)	Averaging Time (non-cancer) (ED-adult x 365 days/year)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	
	CAF	TCE Cancer Adjustment Factor	unitless	0.756	USEPA, 2019 (3)	0.756	USEPA, 2019 (3)	TCE EC (mg/m^3) =
	MAF	TCE Mutagenic Adjust Factor	Unitless	0.244	USEPA, 2019 (3)	0.244	USEPA, 2019 (3)	CIA x 1/AT x
								[(EF x (EDc + EDa) x FT x CAF) +
								((ED0-2 x ET x EF x MAF x 10) + (ED2-6 x ET x EF x MAF x 3) +
								(ED6-16 x ET x EF x MAF x 3) + (ED16-30 x ET x EF x MAF x 1))]

Notes:

(1) For groundwater concentrations, refer to Table 3.36.
(2) Mutagenic groundwater ingestion, dermal contact, and inhalation factors calculated using default age-dependent adjustment factor of 10 for ages 0-2 year, 3 for ages >2 to 16 years, and 1 for ages >16 years as applied for carcinogens that act via a mutagenic mode of action.
(3) The adjustment factors are calculated using the equations presented in RSL (2019) and below:

$$CAF_{oral/dermal} = \frac{CSF_{NHL + Liver}\,[3.7E\text{-}02\ (mg/kg\text{-}d)^{-1}]}{CSF_{adult}\,[4.6E\text{-}02\ (mg/kg\text{-}d)^{-1}]} \qquad MAF_{oral/dermal} = \frac{CSF_{Kidney}\,[9.3E\text{-}03\ (mg/kg\text{-}d)^{-1}]}{CSF_{adult}\,[4.6E\text{-}02\ (mg/kg\text{-}d)^{-1}]}$$

$$CAF_{inhalation} = \frac{IUR_{NHL + Liver}\,[.3.1E\text{-}03\ (mg/m^3)^{-1}]}{IUR_{adult}\,[4.1E\text{-}03\ (mg/m^3)^{-1}]} \qquad MAF_{inhalation} = \frac{IUR_{Kidney}\,[1.0E\text{-}03\ (mg/m^3)^{-1}]}{IUR_{adult}\,[4.1E\text{-}03\ (mg/m_3)^{-1}]}$$

(4) For indoor air concentrations modeled from soil vapor and groundwater, refer to Appendix C.

References:

USEPA, 1989: Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989.
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USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund (RAGS):Volume 1 - Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005, July 2004.
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USEPA, 2011: Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, September.
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Table 4.11

Derivation of DAevent for Groundwater - Resident Dermal Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

DAevent (cm/event) [(1)] - Organics= ET <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ET / PI)

ET > t* =
FA x PC x (ET/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

Mutagenic DAevent (cm/event) [(1)] - Organics= ETWMadj <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ETWMadj / PI)

ETWMadj> t* =
FA x PC x (ETWMadj/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

DAevent (cm/event) [(1)] - Inorganics= PC x ET

Mutagenic DAevent (cm/event) [(1)] - Inorganics= PC x ETWMadj

Chemical of Potential Concern	PC cm/hr	Ref	FA unitless	Ref	MW g/mole	t_{event} hr/event	D_{sc} cm^2/hr	b unitless	c unitless	t* hr	ET hr/event CT	ET hr/event RME	B dimensionless	DAevent (1) cm/event CTE	DAevent (1) cm/event RME
Child															
Volatile Organic Compounds															
1,1-Dichloroethane	6.8E-03	USEPA, 2019	1.0E+00	USEPA, 2004	9.9E+01	3.8E-01	4.4E-07	3.2E-01	3.5E-01	9.0E-01	3.3E-01	5.4E-01	2.6E-02	6.6E-03	8.4E-03
1,2,4-Trichlorobenzene	7.1E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.8E+02	1.1E+00	1.5E-07	5.8E-01	6.1E-01	2.6E+00	3.3E-01	5.4E-01	3.7E-01	1.2E-01	1.5E-01
1,2-Dibromo-3-chloropropane (DBCP)	6.9E-03	USEPA, 2019	1.0E+00	USEPA, 2004	2.4E+02	2.2E+00	7.5E-08	3.3E-01	3.6E-01	5.3E+00	3.3E-01	5.4E-01	4.1E-02	1.6E-02	2.1E-02
1,2-Dichloroethane	4.2E-03	USEPA, 2019	1.0E+00	USEPA, 2004	9.9E+01	3.8E-01	4.4E-07	3.1E-01	3.4E-01	9.0E-01	3.3E-01	5.4E-01	1.6E-02	4.1E-03	5.2E-03
1,4-Dichlorobenzene	4.5E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.5E+02	7.0E-01	2.4E-07	4.5E-01	4.9E-01	1.7E+00	3.3E-01	5.4E-01	2.1E-01	6.0E-02	7.7E-02
Benzene	1.5E-02	USEPA, 2019	1.0E+00	USEPA, 2004	7.8E+01	2.9E-01	5.8E-07	3.3E-01	3.7E-01	6.9E-01	3.3E-01	5.4E-01	5.1E-02	1.3E-02	1.6E-02
Bromodichloromethane	4.0E-03	USEPA, 2019	1.0E+00	USEPA, 2004	1.6E+02	8.7E-01	1.9E-07	3.2E-01	3.5E-01	2.1E+00	3.3E-01	5.4E-01	2.0E-02	5.9E-03	7.6E-03
Chlorobenzene	2.8E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.1E+02	4.5E-01	3.7E-07	3.8E-01	4.1E-01	1.1E+00	3.3E-01	5.4E-01	1.2E-01	3.0E-02	3.8E-02
Chloroform (Trichloromethane)	6.8E-03	USEPA, 2019	1.0E+00	USEPA, 2004	1.2E+02	4.9E-01	3.4E-07	3.2E-01	3.5E-01	1.2E+00	3.3E-01	5.4E-01	2.9E-02	7.6E-03	9.7E-03
cis-1,2-Dichloroethene	1.1E-02	USEPA, 2019	1.0E+00	USEPA, 2004	9.7E+01	3.7E-01	4.5E-07	3.3E-01	3.6E-01	8.8E-01	3.3E-01	5.4E-01	4.2E-02	1.1E-02	1.4E-02
Ethylbenzene	4.9E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.1E+02	4.1E-01	4.0E-07	4.4E-01	4.7E-01	9.9E-01	3.3E-01	5.4E-01	2.0E-01	5.0E-02	6.4E-02
Methylene chloride	3.5E-03	USEPA, 2019	1.0E+00	USEPA, 2004	8.5E+01	3.1E-01	5.3E-07	3.1E-01	3.4E-01	7.5E-01	3.3E-01	5.4E-01	1.3E-02	3.1E-03	4.0E-03
Toluene	3.1E-02	USEPA, 2019	1.0E+00	USEPA, 2004	9.2E+01	3.4E-01	4.8E-07	3.8E-01	4.1E-01	8.3E-01	3.3E-01	5.4E-01	1.1E-01	2.9E-02	3.7E-02
Trichloroethene	1.2E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.3E+02	5.7E-01	2.9E-07	3.4E-01	3.7E-01	1.4E+00	3.3E-01	5.4E-01	5.1E-02	1.4E-02	1.8E-02
Vinyl chloride	8.4E-03	USEPA, 2019	1.0E+00	USEPA, 2004	6.2E+01	2.4E-01	7.1E-07	3.2E-01	3.5E-01	5.6E-01	3.3E-01	5.4E-01	2.5E-02	6.5E-03	8.3E-03
Xylenes (total)	5.0E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.1E+02	4.1E-01	4.0E-07	4.4E-01	4.8E-01	9.9E-01	3.3E-01	5.4E-01	2.0E-01	5.1E-02	6.5E-02
Semi-Volatiles Organic Compounds															
Biphenyl (1,1-Biphenyl)	9.4E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.5E+02	7.7E-01	2.2E-07	6.6E-01	6.8E-01	1.8E+00	3.3E-01	5.4E-01	4.5E-01	1.3E-01	1.7E-01
bis(2-Ethylhexyl)phthalate (DEHP)	1.1E+00	USEPA, 2019	1.0E+00	USEPA, 2004	3.9E+02	1.6E+01	1.0E-08	5.0E+01	8.6E+00	7.3E+01	3.3E-01	5.4E-01	8.6E+00	7.2E+00	9.2E+00
Naphthalene	4.7E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.3E+02	5.5E-01	3.0E-07	4.4E-01	4.8E-01	1.3E+00	3.3E-01	5.4E-01	2.0E-01	5.5E-02	7.0E-02

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Moraine, Ohio

DAevent (cm/event) [(1)] - Organics= ET <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ET / PI)

ET > t* =
FA x PC x (ET/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

Mutagenic DAevent (cm/event) [(1)] - Organics= ETWMadj <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ETWMadj / PI)

ETWMadj> t* =
FA x PC x (ETWMadj/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

DAevent (cm/event) [(1)] - Inorganics= PC x ET

Mutagenic DAevent (cm/event) [(1)] - Inorganics= PC x ETWMadj

Chemical of Potential Concern	PC cm/hr	Ref	FA unitless	Ref	MW g/mole	t_{event} hr/event	D_{sc} cm^2/hr	b unitless	c unitless	t* hr	ET hr/event CT	ET hr/event RME	B dimensionless	DAevent (1) cm/event CTE	DAevent (1) cm/event RME
Child															
Metals															
Aluminum	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Antimony	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Arsenic	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Barium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Beryllium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Cadmium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Chromium	2.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	6.6E-04	1.1E-03
Cobalt	4.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	1.3E-04	2.2E-04
Copper	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Cyanide (total)	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Iron	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Lead	1.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-05	5.4E-05
Manganese	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Mercury	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Nickel	2.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	6.6E-05	1.1E-04
Selenium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Thallium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Vanadium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	3.3E-04	5.4E-04
Zinc	6.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	3.3E-01	5.4E-01	--	2.0E-04	3.2E-04

Table 4.11

Derivation of DAevent for Groundwater - Resident Dermal Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

DAevent (cm/event) [(1)] - Organics= ET <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ET / PI)

ET > t* =
FA x PC x (ET/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

Mutagenic DAevent (cm/event) [(1)] - Organics= ETWMadj <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ETWMadj / PI)

ETWMadj> t* =
FA x PC x (ETWMadj/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

DAevent (cm/event) [(1)] - Inorganics= PC x ET

Mutagenic DAevent (cm/event) [(1)] - Inorganics= PC x ETWMadj

Chemical of Potential Concern	PC cm/hr	Ref	FA unitless	Ref	MW g/mole	t_{event} hr/event	D_{sc} cm^2/hr	b unitless	c unitless	t* hr	ET hr/event CT	ET hr/event RME	B dimensionless	DAevent (1) cm/event CTE	DAevent (1) cm/event RME
Adult															
Volatile Organic Compounds															
1,1-Dichloroethane	6.8E-03	USEPA, 2019	1.0E+00	USEPA, 2004	9.9E+01	3.8E-01	4.4E-07	3.2E-01	3.5E-01	9.0E-01	2.5E-01	7.1E-01	2.6E-02	5.7E-03	9.6E-03
1,2,4-Trichlorobenzene	7.1E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.8E+02	1.1E+00	1.5E-07	5.8E-01	6.1E-01	2.6E+00	2.5E-01	7.1E-01	3.7E-01	1.0E-01	1.7E-01
1,2-Dibromo-3-chloropropane (DBCP)	6.9E-03	USEPA, 2019	1.0E+00	USEPA, 2004	2.4E+02	2.2E+00	7.5E-08	3.3E-01	3.6E-01	5.3E+00	2.5E-01	7.1E-01	4.1E-02	1.4E-02	2.4E-02
1,2-Dichloroethane	4.2E-03	USEPA, 2019	1.0E+00	USEPA, 2004	9.9E+01	3.8E-01	4.4E-07	3.1E-01	3.4E-01	9.0E-01	2.5E-01	7.1E-01	1.6E-02	3.6E-03	6.0E-03
1,4-Dichlorobenzene	4.5E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.5E+02	7.0E-01	2.4E-07	4.5E-01	4.9E-01	1.7E+00	2.5E-01	7.1E-01	2.1E-01	5.2E-02	8.8E-02
Benzene	1.5E-02	USEPA, 2019	1.0E+00	USEPA, 2004	7.8E+01	2.9E-01	5.8E-07	3.3E-01	3.7E-01	6.9E-01	2.5E-01	7.1E-01	5.1E-02	1.1E-02	1.9E-02
Bromodichloromethane	4.0E-03	USEPA, 2019	1.0E+00	USEPA, 2004	1.6E+02	8.7E-01	1.9E-07	3.2E-01	3.5E-01	2.1E+00	2.5E-01	7.1E-01	2.0E-02	5.2E-03	8.7E-03
Chlorobenzene	2.8E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.1E+02	4.5E-01	3.7E-07	3.8E-01	4.1E-01	1.1E+00	2.5E-01	7.1E-01	1.2E-01	2.6E-02	4.4E-02
Chloroform (Trichloromethane)	6.8E-03	USEPA, 2019	1.0E+00	USEPA, 2004	1.2E+02	4.9E-01	3.4E-07	3.2E-01	3.5E-01	1.2E+00	2.5E-01	7.1E-01	2.9E-02	6.6E-03	1.1E-02
cis-1,2-Dichloroethene	1.1E-02	USEPA, 2019	1.0E+00	USEPA, 2004	9.7E+01	3.7E-01	4.5E-07	3.3E-01	3.6E-01	8.8E-01	2.5E-01	7.1E-01	4.2E-02	9.2E-03	1.6E-02
Ethylbenzene	4.9E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.1E+02	4.1E-01	4.0E-07	4.4E-01	4.7E-01	9.9E-01	2.5E-01	7.1E-01	2.0E-01	4.4E-02	7.4E-02
Methylene chloride	3.5E-03	USEPA, 2019	1.0E+00	USEPA, 2004	8.5E+01	3.1E-01	5.3E-07	3.1E-01	3.4E-01	7.5E-01	2.5E-01	7.1E-01	1.3E-02	2.7E-03	4.6E-03
Toluene	3.1E-02	USEPA, 2019	1.0E+00	USEPA, 2004	9.2E+01	3.4E-01	4.8E-07	3.8E-01	4.1E-01	8.3E-01	2.5E-01	7.1E-01	1.1E-01	2.5E-02	4.3E-02
Trichloroethene	1.2E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.3E+02	5.7E-01	2.9E-07	3.4E-01	3.7E-01	1.4E+00	2.5E-01	7.1E-01	5.1E-02	1.2E-02	2.0E-02
Vinyl chloride	8.4E-03	USEPA, 2019	1.0E+00	USEPA, 2004	6.2E+01	2.4E-01	7.1E-07	3.2E-01	3.5E-01	5.6E-01	2.5E-01	7.1E-01	2.5E-02	5.6E-03	9.8E-03
Xylenes (total)	5.0E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.1E+02	4.1E-01	4.0E-07	4.4E-01	4.8E-01	9.9E-01	2.5E-01	7.1E-01	2.0E-01	4.4E-02	7.5E-02
Semi-Volatiles Organic Compounds															
Biphenyl (1,1-Biphenyl)	9.4E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.5E+02	7.7E-01	2.2E-07	6.6E-01	6.8E-01	1.8E+00	2.5E-01	7.1E-01	4.5E-01	1.1E-01	1.9E-01
bis(2-Ethylhexyl)phthalate (DEHP)	1.1E+00	USEPA, 2019	1.0E+00	USEPA, 2004	3.9E+02	1.6E+01	1.0E-08	5.0E+01	8.6E+00	7.3E+01	2.5E-01	7.1E-01	8.6E+00	6.3E+00	1.1E+01
Naphthalene	4.7E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.3E+02	5.5E-01	3.0E-07	4.4E-01	4.8E-01	1.3E+00	2.5E-01	7.1E-01	2.0E-01	4.8E-02	8.0E-02

Table 4.11

Derivation of DAevent for Groundwater - Resident Dermal Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

DAevent (cm/event) [(1)] - Organics= ET <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ET / PI)

ET > t* =
FA x PC x (ET/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

Mutagenic DAevent (cm/event) [(1)] - Organics= ETWMadj <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ETWMadj / PI)

ETWMadj> t* =
FA x PC x (ETWMadj/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

DAevent (cm/event) [(1)] - Inorganics= PC x ET

Mutagenic DAevent (cm/event) [(1)] - Inorganics= PC x ETWMadj

Chemical of Potential Concern	PC cm/hr	Ref	FA unitless	Ref	MW g/mole	t_{event} hr/event	D_{sc} cm^2/hr	b unitless	c unitless	t* hr	ET hr/event CT	ET hr/event RME	B dimensionless	DAevent (1) cm/event CTE	DAevent (1) cm/event RME
Adult															
Metals															
Aluminum	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Antimony	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Arsenic	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Barium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Beryllium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Cadmium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Chromium	2.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	6.6E-04	1.1E-03
Cobalt	4.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	1.0E-04	2.8E-04
Copper	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Cyanide (total)	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Iron	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Lead	1.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-05	7.1E-05
Manganese	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Mercury	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Nickel	2.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	5.0E-05	1.4E-04
Selenium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Thallium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Vanadium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	2.5E-04	7.1E-04
Zinc	6.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	2.5E-01	7.1E-01	--	1.5E-04	4.3E-04

Table 4.11

Derivation of DAevent for Groundwater - Resident Dermal Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

DAevent (cm/event) [(1)] - Organics= ET <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ET / PI)

ET > t* =
FA x PC x (ET/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

Mutagenic DAevent (cm/event) [(1)] - Organics= ETWMadj <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ETWMadj / PI)

ETWMadj> t* =
FA x PC x (ETWMadj/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

DAevent (cm/event) [(1)] - Inorganics= PC x ET

Mutagenic DAevent (cm/event) [(1)] - Inorganics= PC x ETWMadj

Chemical of Potential Concern	PC cm/hr	Ref	FA unitless	Ref	MW g/mole	t_{event} hr/event	D_{sc} cm^2/hr	b unitless	c unitless	t* hr	ET hr/event CT	ET hr/event RME	B dimensionless	DAevent (1) cm/event CTE	DAevent (1) cm/event RME
Child and Adult - Mutagenic Mode, Age-adjusted															
Volatile Organic Compounds															
1,2-Dibromo-3-chloropropane (DBCP)	6.9E-03	USEPA, 2019	1.0E+00	USEPA, 2004	2.4E+02	2.2E+00	7.5E-08	3.3E-01	3.6E-01	5.3E+00	3.0E-01	7.8E-01	4.1E-02	1.5E-02	2.5E-02
Methylene chloride	3.5E-03	USEPA, 2019	1.0E+00	USEPA, 2004	8.5E+01	3.1E-01	5.3E-07	3.1E-01	3.4E-01	7.5E-01	3.0E-01	7.8E-01	1.3E-02	3.0E-03	5.0E-03
Trichloroethene	1.2E-02	USEPA, 2019	1.0E+00	USEPA, 2004	1.3E+02	5.7E-01	2.9E-07	3.4E-01	3.7E-01	1.4E+00	3.0E-01	7.8E-01	5.1E-02	1.3E-02	2.1E-02
Vinyl chloride	8.4E-03	USEPA, 2019	1.0E+00	USEPA, 2004	6.2E+01	2.4E-01	7.1E-07	3.2E-01	3.5E-01	5.6E-01	3.0E-01	7.8E-01	2.5E-02	6.2E-03	1.0E-02
Metals															
Chromium VI	2.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	3.0E-01	7.8E-01	--	6.6E-04	1.1E-03

Notes:

(1) DA_{event} calculated consistent with USEPA (2004) equation.

References:

USEPA, 2004: RAGs Volume 1, Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July.
USEPA, 2019: Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April.

Table 4.12

Values Used for Daily Intake Calculations - Construction/Utility Worker Exposure to Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater
Exposure Medium: Groundwater
Receptor Population: Construction/Utility Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Groundwater	mg/L	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR	Ingestion Rate	L/hour	0.02	Virginia DEQ, 2018	0.02	Virginia DEQ, 2018	CW x IR x ET x EF x ED x 1/BW x 1/AT
	ET	Exposure Time	hour/day	1	(2)	1	(2)	
	EF	Exposure Frequency	days/year	120	Ohio VAP, 2016	60	(3)	
	ED	Exposure Duration	years	1	USEPA, 2002	1	USEPA, 2002	
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	365	USEPA, 1989	365	USEPA, 1989	
Dermal	CW	Chemical Concentration in Groundwater	mg/L	(1)	(1)	(1)	(1)	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2	3,527	USEPA, 2014	3,527	USEPA, 2014	DAevent x SA x EF x EV x ED x 1/BW x 1/AT
	CF	Conversion Factor	L/cm^3	1.00E-03	--	1.00E-03	--	
	EV	Event Frequency	event/day	1	USEPA, 2004	1	USEPA, 2004	DAevent (mg/cm^2-event) - Inorganics=
	t_{event}	Event duration	hour/event	1	(2)	1	(2)	PC x t_{event} x CW x CF
	EF	Exposure Frequency	days/year	120	Ohio VAP, 2016	60	(3)	
	ED	Exposure Duration	years	1	USEPA, 2002	1	USEPA, 2002	DAevent (mg/cm^2-event) - Organics=
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	t_{event} <= t* =
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	2 x FA x PC x CW x CF x SQRT(6 x τ_{event} x t_{event} / π)
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	365	USEPA, 1989	365	USEPA, 1989	t_{event} > t* =
	FA	Fraction Absorbed	unitless	chemical-specific	Refer to Table 4.13	chemical-specific	Refer to Table 4.13	FA x PC x CW x CFx (t_{event}/(1+B)+2 x τ_{event} x ((1+3B+$3B^2$)/$(1+B)^2$)
	PC	Permeability Constant	cm/hour	chemical-specific	Refer to Table 4.13	chemical-specific	Refer to Table 4.13	t* =2.4 x τ_{event}
	τ_{event}	Lag Time per event	hr/event	chemical specific	Refer to Table 4.13	chemical specific	Refer to Table 4.13	
	B	Constant	dimensionless	chemical specific	Refer to Table 4.13	chemical specific	Refer to Table 4.13	

Table 4.12

Values Used for Daily Intake Calculations - Construction/Utility Worker Exposure to Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Groundwater
Exposure Medium: Groundwater
Receptor Population: Construction/Utility Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CTE Value	CTE Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CW	Chemical Concentration in Groundwater	mg/L	(1)	(1)	(1)	(1)	Exposure Concentration (EC) (mg/m^3) =
	FT	Fraction Time Exposed	unitless	8/24	USEPA, 2014	8/24	USEPA, 2014	CW x FT x EF x ED x VF x 1/AT
	EF	Exposure Frequency	days/year	120	Ohio VAP, 2016	60	(3)	
	ED	Exposure Duration	years	1	USEPA, 2002	1	USEPA, 2002	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	365	USEPA, 1989	365	USEPA, 1989	
	VF	Volatilization Factor	L/m^3	chemical-specific	Refer to Table 4.14	chemical-specific	Refer to Table 4.14	

Notes:

(1) For groundwater concentrations in Floodplain, refer to Table 3.38. For groundwater concentrations in OU1, refer to Table 3.39.
(2) Assumes a construction/utility worker is in direct contact with the medium for a limited time (1 hour/day) spent on the Site.
(3) An exposure frequency of 120 days/year for construction/excavation activities was chosen by Ohio EPA on the basis of best professional judgment (Ohio VAP Part C, p. 41). The CT is half the RME value.

References:

Ohio VAP, 2016: Suport Document for the Development of Generic Numerical Standards and Risk Assessment Procedures, Table 4: Summary of all scenario and receptor-specific parameters, May 2016.
USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A OERR. EPA/540-1-89-002.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.
USEPA, 2004: RAGs Volume 1, Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.
Virginia DEQ, 2018, Virginia Unified Risk Assessment Model – VURAM 2.0 User's Guide (http://www.deq.virginia.gov/Programs/LandProtectionRevitalization/RemediationProgram/RiskAssessment.aspx)

Table 4.13

Derivation of DAevent for Groundwater - Construction/Utility Worker Dermal Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

DAevent (cm/event) [(1)] - Organics=

ET <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ET / PI)

ET > t* =
FA x PC x (ET/(1+B)+2 x t_{event} x ((1+3B+3B^2)/(1+B)^2)
t* =2.4 x t_{event}

DAevent (cm/event) [(1)] - Inorganics= PC x ET

Chemical of Potential Concern	PC cm/hr	Ref	FA unitless	Ref	MW g/mole	t_{event} hr/event	D_{sc} cm^2/hr	b unitless	c unitless	t* hr	ET hr/event	B dimensionless	DAevent (1) cm/event
Volatile Organic Compounds													
1,1-Dichloroethane	6.8E-03	USEPA, 2019	1	USEPA, 2004	99	3.8E-01	4.4E-07	3.2E-01	3.5E-01	9.0E-01	1.0E+00	2.6E-02	1.2E-02
1,2,4-Trichlorobenzene	7.1E-02	USEPA, 2019	1	USEPA, 2004	181	1.1E+00	1.5E-07	5.8E-01	6.1E-01	2.6E+00	1.0E+00	3.7E-01	2.0E-01
1,2-Dibromo-3-chloropropane (DBCP)	6.9E-03	USEPA, 2019	1	USEPA, 2004	236	2.2E+00	7.5E-08	3.3E-01	3.6E-01	5.3E+00	1.0E+00	4.1E-02	2.8E-02
1,2-Dichloroethane	4.2E-03	USEPA, 2019	1	USEPA, 2004	99	3.8E-01	4.4E-07	3.1E-01	3.4E-01	9.0E-01	1.0E+00	1.6E-02	7.3E-03
1,4-Dichlorobenzene	4.5E-02	USEPA, 2019	1	USEPA, 2004	147	7.0E-01	2.4E-07	4.5E-01	4.9E-01	1.7E+00	1.0E+00	2.1E-01	1.0E-01
Benzene	1.5E-02	USEPA, 2019	1	USEPA, 2004	78	2.9E-01	5.8E-07	3.3E-01	3.7E-01	6.9E-01	1.0E+00	5.1E-02	2.3E-02
Bromodichloromethane	4.0E-03	USEPA, 2019	1	USEPA, 2004	164	8.7E-01	1.9E-07	3.2E-01	3.5E-01	2.1E+00	1.0E+00	2.0E-02	1.0E-02
Chlorobenzene	2.8E-02	USEPA, 2019	1	USEPA, 2004	113	4.5E-01	3.7E-07	3.8E-01	4.1E-01	1.1E+00	1.0E+00	1.2E-01	5.2E-02
Chloroform (Trichloromethane)	6.8E-03	USEPA, 2019	1	USEPA, 2004	119	4.9E-01	3.4E-07	3.2E-01	3.5E-01	1.2E+00	1.0E+00	2.9E-02	1.3E-02
cis-1,2-Dichloroethene	1.1E-02	USEPA, 2019	1	USEPA, 2004	97	3.7E-01	4.5E-07	3.3E-01	3.6E-01	8.8E-01	1.0E+00	4.2E-02	1.9E-02
Ethylbenzene	4.9E-02	USEPA, 2019	1	USEPA, 2004	106	4.1E-01	4.0E-07	4.4E-01	4.7E-01	9.9E-01	1.0E+00	2.0E-01	9.0E-02
Methylene chloride	3.5E-03	USEPA, 2019	1	USEPA, 2004	85	3.1E-01	5.3E-07	3.1E-01	3.4E-01	7.5E-01	1.0E+00	1.3E-02	5.7E-03
Toluene	3.1E-02	USEPA, 2019	1	USEPA, 2004	92	3.4E-01	4.8E-07	3.8E-01	4.1E-01	8.3E-01	1.0E+00	1.1E-01	5.2E-02
Trichloroethene	1.2E-02	USEPA, 2019	1	USEPA, 2004	131	5.7E-01	2.9E-07	3.4E-01	3.7E-01	1.4E+00	1.0E+00	5.1E-02	2.4E-02
Vinyl chloride	8.4E-03	USEPA, 2019	1	USEPA, 2004	62	2.4E-01	7.1E-07	3.2E-01	3.5E-01	5.6E-01	1.0E+00	2.5E-02	1.2E-02
Xylenes (total)	5.0E-02	USEPA, 2019	1	USEPA, 2004	106	4.1E-01	4.0E-07	4.4E-01	4.8E-01	9.9E-01	1.0E+00	2.0E-01	9.1E-02
Semi-Volatiles Organic Compounds													
Biphenyl (1,1-Biphenyl)	9.4E-02	USEPA, 2019	1	USEPA, 2004	154	7.7E-01	2.2E-07	6.6E-01	6.8E-01	1.8E+00	1.0E+00	4.5E-01	2.3E-01
bis(2-Ethylhexyl)phthalate (DEHP)	1.1E+00	USEPA, 2019	1	USEPA, 2004	391	1.6E+01	1.0E-08	5.0E+01	8.6E+00	7.3E+01	1.0E+00	8.6E+00	1.3E+01
Naphthalene	4.7E-02	USEPA, 2019	1	USEPA, 2004	128	5.5E-01	3.0E-07	4.4E-01	4.8E-01	1.3E+00	1.0E+00	2.0E-01	9.5E-02

Table 4.13

Derivation of DAevent for Groundwater - Construction/Utility Worker Dermal Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

DAevent (cm/event) [(1)] - Organics=

ET <= t* =
2 x FA x PC x SQRT(6 x t_{event} x ET / PI)

ET > t* =
FA x PC x (ET/(1+B)+2 x t_{event} x (($1+3B+3B^2$)/$(1+B)^2$))
t* =2.4 x t_{event}

DAevent (cm/event) [(1)] - Inorganics= PC x ET

Chemical of Potential Concern	PC cm/hr	Ref	FA unitless	Ref	MW g/mole	t_{event} hr/event	D_{sc} cm^2/hr	b unitless	c unitless	t* hr	ET hr/event	B dimensionless	DAevent (1) cm/event
Metals													
Aluminum						--	--	--	--	--	1.0E+00	--	0.0E+00
Antimony	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Arsenic	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Barium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Beryllium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Cadmium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Chromium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Cobalt	2.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	2.0E-03
Copper	4.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	4.0E-04
Cyanide (total)	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Iron	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Lead	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Manganese	1.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-04
Mercury	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Nickel	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Selenium	2.0E-04	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	2.0E-04
Thallium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Vanadium	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
Zinc	1.0E-03	USEPA, 2019	--	--	--	--	--	--	--	--	1.0E+00	--	1.0E-03
	6.00E-04	USEPA, 2019	--	--	--								

Notes:

(1) DA_{event} calculated consistent with USEPA (2004) equation.

References:

USEPA, 2004: RAGs Volume 1, Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July.
USEPA, 2019: Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, April.

Table 4.14

Derivation of Volatilization Factor (VF) for Groundwater - Construction/ Utility Worker Inhalation Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemical of Potential Concern	Molecular Weight, MW_i (1) (g/mol)	Henry's Law Constant, H_i (1) (atm-m^3/mol)	Liquid Phase Coefficient, k_{iL} (2) (cm/s)	Gas Phase Coefficient, k_{iG} (3) (cm/s)	Overall Mass Transfer Coefficient, Ki (4) (cm/s)	Volatilization Factor, VF (5) (L/m^3)
VOCs						
1,1-Dichloroethane	9.9E+01	5.6E-03	1.1E-03	4.7E-01	1.1E-03	1.7E-01
1,2,4-Trichlorobenzene	1.8E+02	1.4E-03	8.4E-04	3.8E-01	8.1E-04	1.2E-01
1,2-Dibromo-3-chloropropane (DBCP)	2.4E+02	1.5E-04	7.4E-04	3.5E-01	5.5E-04	8.1E-02
1,2-Dichloroethane	9.9E+01	1.2E-03	1.1E-03	4.7E-01	1.1E-03	1.6E-01
1,4-Dichlorobenzene	1.5E+02	2.4E-03	9.3E-04	4.1E-01	9.1E-04	1.4E-01
Benzene	7.8E+01	5.6E-03	1.3E-03	5.1E-01	1.3E-03	1.9E-01
Bromodichloromethane	1.6E+02	2.1E-03	8.8E-04	4.0E-01	8.6E-04	1.3E-01
Chlorobenzene	1.1E+02	3.1E-03	1.1E-03	4.5E-01	1.0E-03	1.6E-01
Chloroform (Trichloromethane)	1.2E+02	3.7E-03	1.0E-03	4.4E-01	1.0E-03	1.5E-01
cis-1,2-Dichloroethene	9.7E+01	4.1E-03	1.1E-03	4.7E-01	1.1E-03	1.7E-01
Ethylbenzene	1.1E+02	7.9E-03	1.1E-03	4.6E-01	1.1E-03	1.6E-01
Methylene chloride	8.5E+01	3.3E-03	1.2E-03	5.0E-01	1.2E-03	1.8E-01
Toluene	9.2E+01	6.6E-03	1.2E-03	4.8E-01	1.2E-03	1.7E-01
Trichloroethene	1.3E+02	9.9E-03	9.9E-04	4.3E-01	9.8E-04	1.5E-01
Vinyl chloride	6.2E+01	2.8E-02	1.4E-03	5.5E-01	1.4E-03	2.1E-01
Xylenes (total)	1.1E+02	6.6E-03	1.1E-03	4.6E-01	1.1E-03	1.6E-01
SVOCs						
Biphenyl (1,1-Biphenyl)	1.5E+02	3.1E-04	9.1E-04	4.1E-01	7.7E-04	1.1E-01
Naphthalene	1.3E+02	4.4E-04	1.0E-03	4.3E-01	8.9E-04	1.3E-01
Metals						
Mercury	2.0E+02	8.6E-03	8.0E-04	3.7E-01	7.9E-04	1.2E-01

Temperature, T (K):	298.15
Ideal Gas Constant, R (atm-m^3/mole-K):	0.000082
Area of Trench, A (m^2):	10
Volume of Trench, V (m^3):	30
Depth of the trench, D, (m):	3
Width of the trench, W, (m):	1
Length of the trench, L, (m):	10
Wind speed 10 m above the water surface, u (m/s):	0.45
Air changes per hour, ACH (hr^{-1}):	162
mixing factor (deviation from complete mixing in real conditions, k [unitless]):	0.5
Fraction of trench floor through which contaminant can enter, F (unitless):	1
Molecular weight of Oxygen, MW_{O2} (g/mol)	16
liquid-phase mass transfer coefficient for oxygen at 25°C, k_L,O_2 (cm/s).	0.002
Conversion Factor, CF_1 (cm^2/m^2);	10000
Conversion Factor, CF_2 (L/cm^3);	0.001
Conversion Factor, CF_3 (sec/hr);	3600

Notes:

(1) Regional Screening Level (RSL) Chemical-specific Parameters Supporting Table, November 2019.

(2) Calculated using the following equation:

$$k_{iL} = \left(\frac{MW_{O_2}}{MW_i}\right)^{0.5} \left(\frac{T}{298}\right)(k_L, O_2)$$

(3) Calculated using the following equation:

$$k_{iG} = \left(\frac{MW_{H_2O}}{MW_i}\right)^{0.335} \left(\frac{T}{298}\right)^{1.005} \left(k_{iG}, H_2O\right)$$

(4) Calculated using the following equation:

$$\frac{1}{K_i} = \frac{1}{k_{iL}} + \frac{RT}{H_i k_{iG}}$$

(5) Calculated using the following equation:

$$VF_i = \frac{(K_i \times A \times F \times CF_1 \times CF_2 \times CF_3)}{(k \times ACH \times V)}$$

Table 4.15

Values Used for Daily Intake Calculations - Current/Future Recreational User Exposure to Floodplain Surface Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Floodplain Surface Soil
Exposure Medium: Surface Soil
Receptor Population: Recreational User
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Surface Soil	mg/kg	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR - child	Ingestion Rate of Soil	mg soil/day	200	USEPA, 2002	200	USEPA, 2002	CS x IR x CF x ABS x EF x ED x 1/BW x 1/AT
	IR - adult	Ingestion Rate of Soil	mg soil/day	100	USEPA, 2002	100	USEPA, 2002	
	IFSMadj	Mutagenic Soil Ingestion Rate - Age-adjusted	mg-year/kg-day	477	USEPA, 2005 (2)	438	USEPA, 2005 (2)	
	CF	Conversion Factor	kg/mg	1.00E-06	--	1.00E-06	--	Mutagenic CDI (mg/kg-day) =
	EF	Exposure Frequency	days/year	140	(3)	70	(3)	CS x IFSMadj x CF x ABS x EF x 1/AT
	ED - child	Exposure Duration	years	6	USEPA, 2004	6	USEPA, 2004	
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	where IFSMadj =
	BW - child	Body Weight	kg	15	USEPA, 2002	15	USEPA, 2002	$(ED_{0-2}$ x IR-child x 10 / BW-child) +
	BW - adult	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	$(ED_{2-6}$ x IR-child x 3 / BW-child) +
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	$(ED_{6-16}$ x IR-adult x 3 / BW-adult) +
	AT-N (child)	Averaging Time (non-cancer) (ED-child x 365 days/year)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	$(ED_{16-30}$ x IR-adult x 1 / BW-adult)
	AT-N (adult)	Averaging Time (non-cancer) (ED-adult x 365 days/year)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	
	ABS	Absorption Factor	%/100	chemical-specific	USEPA, 2012 (4)	chemical-specific	USEPA, 2012 (4)	
Dermal	CS	Chemical Concentration in Surface Soil	mg/kg	(1)	(1)	(1)	(1)	CDI (mg/kg-day) =
	SA - child	Skin Surface Area Available for Contact	cm^2	2,373	USEPA, 2014	2,373	USEPA, 2014	CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
	SA - adult	Skin Surface Area Available for Contact	cm^2	6,032	USEPA, 2014	6,032	USEPA, 2014	
	DFSMadj	Mutagenic soil dermal contact factor - Age-adjusted	mg-year/kg	1,224	USEPA, 2005 (2)	209	USEPA, 2005 (2)	
	CF	Conversion Factor	kg/mg	1.00E-06	--	1.00E-06	--	Mutagenic CDI (mg/kg-day) =
	EF	Exposure Frequency	days/year	140	(3)	70	(3)	CS x CF x DFSMadj x ABS x EF x 1/AT
	ED - child	Exposure Duration	years	6	USEPA, 2004	6	USEPA, 2004	
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	where DFSMadj =
	BW - child	Body Weight	kg	15	USEPA, 2002	15	USEPA, 2002	$(ED_{0-2}$ x AF-child x SA-child x 10 / BW-child) +
	BW - adult	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	$(ED_{2-6}$ x AF-child x SA-child x 3 / BW-child) +
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	$(ED_{6-16}$ x AF-adult x SA-adult x 3 / BW-adult) +
	AT-N (child)	Averaging Time (non-cancer) (ED-child x 365 days/year)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	$(ED_{16-30}$ x AF-adult x SA-adult x 1 / BW-adult)
	AT-N (adult)	Averaging Time (non-cancer) (ED-adult x 365 days/year)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	
	AF - child	Soil to Skin Adherence Factor	mg/cm^2	0.2	USEPA, 2004	0.04	USEPA, 2004	
	AF - adult	Soil to Skin Adherence Factor	mg/cm^2	0.07	USEPA, 2004	0.01	USEPA, 2004	
	ABS	Absorption Factor	%/100	chemical-specific	(5)	chemical-specific	(5)	

Table 4.15

Values Used for Daily Intake Calculations - Current/Future Recreational User Exposure to Floodplain Surface Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Floodplain Surface Soil
Exposure Medium: Surface Soil
Receptor Population: Recreational User
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Exposure Concentration (EC) (mg/m^3) =
	FT	Fraction of Time Exposed	unitless	1/24	USEPA, 2011 (6)	0.5/24	USEPA, 2011 (6)	CS x FT x EF x ED x (1/PEF + VF) x 1/AT
	IFMadj	Mutagenic inhalation factor - Age-adjusted	years	72	USEPA, 2005 (2)	41	USEPA, 2005 (2)	
	EF	Exposure Frequency	days/year	140	(3)	70	(3)	Mutagenic CDI (mg/m^3) =
	ED - child	Exposure Duration	years	6	USEPA, 2014	6	USEPA, 2004	CS x FT x EF x IFMadj x (1/PEF + VF) x 1/AT
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	where IFMadj =
	AT-N (child)	Averaging Time (non-cancer)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	$(ED_{0-2} \times 10) + (ED_{2-6} \times 3) + (ED_{6-16} \times 3) + (ED_{16-30} \times 1)$
	AT-N (adult)	Averaging Time (non-cancer)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	
	PEF	Particulate Emission Factor	m^3/kg	1.36E+09	USEPA, 2002	1.36E+09	USEPA, 2002	
	VF	Volatilization Factor	m^3/kg	chemical-specific	Refer to Table 4.4	chemical-specific	Refer to Table 4.4	

Notes:

(1) For Floodplain surface soil concentrations, refer to Table 3.45.
(2) Mutagenic soil ingestion, dermal contact, and inhalation factors calculated using default age-dependent adjustment factor of 10 for ages 0-2 year, 3 for ages >2 to 16 years, and 1 for ages >16 years as applied for carcinogens that act via a mutagenic mode of action.
(3) Professional Judgement; based on recreational users using the pathway 4 times per week through the months of April to November (35 weeks). CTE is half the RME value.
(4) The default assumption of 100% is applied for all parameters with the exception of arsenic at 60%.
(5) USEPA 2004 Exhibit 3-4 and metals of 1% as recommeded by Region 3 Technical Guidance Manual, Risk Assessment https://www.epa.gov/risk/assessing-dermal-exposure-soil
(6) RME exposure time is based on half of the 95th percentile playing on sand/gravel or grass of 121 minutes per day [(121 minutes per day/60 minutes per hour)/2] (U.S. EPA, 2011, Table 16-1. Recommended Values for Activity Patterns). The CTE is half the RME.

References:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A OERR. EPA/540-1-89-002.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, Office of Emergency and Remedial Response, OSWER 9355.4-24, December 2002.
USEPA, 2004: RAGs Volume 1, Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.
USEPA, 2005: Guidelines for Carcinogenic Risk Assessment and Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, March 2005.
USEPA, 2011: Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, September 2011.
USEPA, 2012: Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil, OSWER 9200.1-113, December 2012.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

Table 4.16

Values Used for Daily Intake Calculations - Fish Eater Exposure to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Sediment/ Surface Water
Exposure Medium: Fish Tissue
Receptor Population: Fisher Eater
Receptor Age: Child and Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	Cfish	Concentration in Fish Tissue	mg/kg	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	CRfish - child	Consumption Rate of Fish	kg/meal	0.085	OEPA, 2019 (3)	0.085	OEPA, 2019 (3)	Ifish x EF x ED x 1/BW x 1/AT
	CRfish - adult	Consumption Rate of Fish	kg/meal	0.17	OEPA, 2019	0.17	OEPA, 2019	
	M-CRfish	Mutagenic Consumption Rate of Fish	yr/meal	0.27	USEPA, 2005 (4)	0.27	USEPA, 2005 (4)	Ifish (mg/day) =
	F	Fraction of Fish Consumed that is Contaminated	unitless	1	USEPA, 2005a	1	USEPA, 2005a	Cfish x CRfish x F
	EF	Exposure Frequency	meals/year	8	Professional Judgment (2)	8	Professional Judgment (2)	
	ED - child	Exposure Duration	years	6	USEPA, 2004	6	USEPA, 2004	Mutagenic CDI (mg/kg-day) =
	ED - adult	Exposure Duration	years	20	USEPA, 2014	3	USEPA, 2004	M-Ifish x EF x 1/AT
	BW - child	Body Weight	kg	15	USEPA, 2002	15	USEPA, 2002	
	BW - adult	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	where M-Ifish (mg-yr/kg-meal) =
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	Cfish x M-CRfish
	AT-N (child)	Averaging Time (non-cancer) (ED-child x 365 days/year)	days	2,190	USEPA, 1989	2,190	USEPA, 1989	
	AT-N (adult)	Averaging Time (non-cancer) (ED-adult x 365 days/year)	days	7,300	USEPA, 1989	1,095	USEPA, 1989	

Notes:

(1) For sediment bioaccumulation to fish concentrations, refer to Table 4.17. For surface water bioaccumulation to fish concentrations, refer to Table 4.18.
(2) Professional Judgement; based on 1 meal per month for the months of April throught to October (OPEA, 2019).
(3) Based on half the OEPA recommended fish serving size for an adult (6 oz).
(4) Mutagenic fish ingestion factor calculated using default age-dependent adjustment factor of 10 for ages 0-2 year, 3 for ages >2 to 16 years, and 1 for ages >16 years as applied for carcinogens that act via a mutagenic mode of action.

References:

OEPA, 2019: Ohio Sport Fish Consumption Advisory, Ohio Environmental Protection Agency, March 2019.
USEPA, 1989: Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989.
USEPA, 1997: Exposure Factors Handbook (Final Report), EPA/600/P-95/002F, August 1997.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund (RAGS):Volume 1 - Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005, July 2004.
USEPA, 2005a: Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, EPA/530-R-05-006, September 2005.
USEPA, 2005: Guidelines for Carcinogenic Risk Assessment and Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens, March 2005.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.
USEPA, 2015: Human Health Ambient Water Quality Criteria:2015 Update, Office of Water EPA 829-F-15-001 June 2015.

Table 4.17

Fish Concentration from Bioaccumulation Factors Using Sediment Concentrations
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Organics = $C_{fish} = (C_{sb} \times f_{lipid} \times BSAF) / OC_{sed}$ Inorganics = $C_{fish} = (C_{sb} \times BSAF)$

Chemical of Potential Concern	Sediment Concentration (1) C_{sb} (mg/kg)	Biota-Sediment Accumulation Factor $BSAF_{fish}$ ((mg/kg)/(mg/kg))	Ref	Fish Lipid Content (2) f_{lipid} -	Fraction of Organic Carbon in Bottom Sediment OC_{sed} -	Fish Tissue Concentration (3,4) C_{fish} (mg/kg)
SVOCs						
Acenaphthene	1.28E-01	1.49E-02	Thomann and Komlos 1999	2.00E-02	2.60E-02	1.46E-03
Acenaphthylene	2.25E-02	7.23E-03	Thomann and Komlos 1999	2.00E-02	2.60E-02	1.25E-04
Anthracene	1.23E+00	9.80E-03	Thomann and Komlos 1999	2.00E-02	2.60E-02	9.28E-03
Benzo(a)anthracene	4.20E+00	2.31E-03	Thomann and Komlos 1999	2.00E-02	2.60E-02	7.46E-03
Benzo(a)pyrene	3.63E+00	5.74E-04	Thomann and Komlos 1999	2.00E-02	2.60E-02	1.60E-03
Benzo(b)fluoranthene	5.36E+00	3.86E-04	Thomann and Komlos 1999	2.00E-02	2.60E-02	1.59E-03
Benzo(g,h,i)perylene	1.84E+00	1.09E-04	Thomann and Komlos 1999	2.00E-02	2.60E-02	1.55E-04
Benzo(k)fluoranthene	1.59E+00	3.86E-04	Thomann and Komlos 1999	2.00E-02	2.60E-02	4.72E-04
Chrysene	4.65E+00	2.02E-03	Thomann and Komlos 1999	2.00E-02	2.60E-02	7.23E-03
Dibenz(a,h)anthracene	2.22E-01	8.02E-05	Thomann and Komlos 1999	2.00E-02	2.60E-02	1.37E-05
Fluoranthene	9.43E+00	6.33E-03	Thomann and Komlos 1999	2.00E-02	2.60E-02	4.59E-02
Fluorene	1.38E-01	1.29E-02	Thomann and Komlos 1999	2.00E-02	2.60E-02	1.37E-03
Indeno(1,2,3-cd)pyrene	1.82E+00	7.89E-05	Thomann and Komlos 1999	2.00E-02	2.60E-02	1.10E-04
Phenanthrene	5.82E+00	9.57E-03	Thomann and Komlos 1999	2.00E-02	2.60E-02	4.28E-02
Pyrene	6.68E+00	7.47E-03	Thomann and Komlos 1999	2.00E-02	2.60E-02	3.84E-02
Metals						
Arsenic	1.35E+01	Regression	Bechtel Jacobs, 1998	NA	NA	9.06E-01
Cadmium	4.66E-01	Regression	Bechtel Jacobs, 1998	NA	NA	1.61E-01
Chromium	1.55E+01	Regression	Bechtel Jacobs, 1998	NA	NA	1.10E+00
Copper	2.64E+01	Regression	Bechtel Jacobs, 1998	NA	NA	7.62E+00
Lead	4.72E+01	Regression	Bechtel Jacobs, 1998	NA	NA	9.17E-01
Methyl mercury	3.34E-04	1.43E+01	(5)	NA	NA	4.78E-03
Nickel	1.81E+01	Regression	Bechtel Jacobs, 1998	NA	NA	2.21E+00
Selenium	9.74E-01	2.50E-01	(6)	NA	NA	2.44E-01
Silver	1.16E-01	2.50E-01	(6)	NA	NA	2.90E-02
Zinc	1.24E+02	Regression	Bechtel Jacobs, 1998	NA	NA	4.30E+01
Polychlorinated Biphenyls						
Aroclor-1242 (PCB-1242)	5.42E-02	2.00E+00	USEPA, 2005	2.00E-02	2.60E-02	8.33E-02
Aroclor-1254 (PCB-1254)	1.22E-01	2.00E+00	USEPA, 2005	2.00E-02	2.60E-02	1.87E-01
Pesticides						
alpha-Chlordane	5.50E-03	2.00E+00	USEPA, 2005	2.00E-02	2.60E-02	8.46E-03
gamma-Chlordane	3.40E-03	2.00E+00	USEPA, 2005	2.00E-02	2.60E-02	5.23E-03

Notes:

(1) For sediment concentrations, refer to Table 3.41.

(2) The Quarry Pond is warm water habitat with fringe of macrophyte beds. Thus, dominant fish will likely be those adapted to reproduction in small ponds, notably sunfish, predatory bass, and bullheads. EPA (1995) surveyed lipid levels in edible portions of fish native to the Great Lakes, and found that these species had low lipid levels in edible tissues; i.e., less than 1% lipid in the bluegills and largemouth bass and less than 2% in the bullheads. Thus, an average of 2% lipid was used as a conservative value.

(3) Except for metals, C_{fish} calculated consistent with USEPA (2005) equation.

(4) C_{fish} for metals calculated based on Bechtel Jacobs (1998) models for benthos. See Section 2.3.3.3.

(5) Geometric mean of Median Site BSAF (Amec Foster Wheeler Technical Memorandum, 2017).

(6) Dry weight fish to dry weight sediment BSAF of 1.0, divided by 4 to yield wet weight concentrations in fish.

Reference:

Amec Foster Wheeler Technical Memorandum, Penobscot River Phase III Engineering Study, WO3A-010 Task 2 BSAF Calculations, Summary of Biota-Sediment Accumulation Factor Evaluation, Amec Foster Wheeler Project No. 3616166052, September 14, 2017.

Bechtel Jacobs, 1998. Biota sediment accumulation factors for invertebrates: review and recommendations for the Oak Ridge Reservation. Bechtel Jacobs Company LLC, Oak Ridge, TN. BJC/OR 112. Available from: http://www.hsrd.ornl.gov/ecorisk/bjcor 112a1.pdf

Thomann, R. V. and J. Komlos. 1999. Model of biota-sediment accumulation factor for polycyclic aromatic hydrocarbons. Environ. Toxicol. Chem. 18: 1060–1068.

USEPA. 1995. Great Lakes Water Quality Initiative Technical Support Document for the Procedure to Determine Bioaccumulation Factors. Office of Water EPA-820-B-95-005 March 1995

USEPA, 2005: Human Health Risk Assessment Protocol for Hazardous Waste Combustion Facilities, EPA/530-R-05-006, September 2005.

Table 4.18

Fish Concentration from Bioaccumulation Factors Using Surface Water Concentrations
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Inorganics = $C_{fish} = (C_{sw} \times BCF)$

Chemical of Potential Concern	Surface Water Concentration (1) C_{sw} (mg/L)	Bioconcentration Factor BCF_{fish} (L/kg)	Ref	Fish Tissue Concentration C_{fish} (mg/kg)
Metals				
Arsenic	5.00E-03	4.00E+00	USEPA, 1980	2.00E-02
Manganese	7.52E-01	2.20E+02 (2)	ODEQ, 2010	1.65E+02
Thallium	2.83E-04	3.40E+01	USEPA, 1980	9.62E-03

Note:

(1) For surface water concentrations, refer to Table 3.43.
(2) BCF is the maximum freshwater BCF as presented in Table 5 (ODEQ, 2010).

Reference:

USEPA, 1980: Ambient Water Quality Criteria, October 1980.
ODEQ, 2010: Attachment D, Water Quality Standards Review and Recommendations: Iron and Manganese, Oregon DEQ, December 9, 2010 EQC Meeting (https://www.oregon.gov/deq/FilterDocs/AttDIssuePaperFeMn.pdf).

Table 4.19

Values Used for Daily Intake Calculations - Trespasser Exposure Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Water
Exposure Medium: Surface Water
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Surface Water	mg/L	(1)	--	(1)	--	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR	Ingestion Rate of Water	L/hour	0.124	USEPA, 2019	0.124	USEPA, 2019	CW x IR x ET x EF x ED x 1/BW x 1/AT
	ET	Exposure Time	hours/day	1	USEPA, 2011 (2)	0.5	USEPA, 2011 (2)	
	EF	Exposure Frequency	days/year	58	USEPA, 2011 (3)	29	USEPA, 2011 (3)	
	ED	Exposure Duration	years	10	USEPA, 2018 (4)	10	USEPA, 2018 (4)	
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	3,650	USEPA, 1989	3,650	USEPA, 1989	
Dermal	CW	Chemical Concentration in Surface Water	mg/L	(1)	--	(1)	--	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2/event	5,537	USEPA, 2011 (5)	5,537	USEPA, 2011 (5)	DAevent x SA x EF x EV x ED x 1/BW x 1/AT
	CF	Conversion Factor	L/cm^3	0.001	--	0.001	--	DAevent (mg/cm^2-event) - Inorganics=
	ET	Exposure Time	hours/day	1	USEPA, 2011 (2)	0.5	USEPA, 2011 (2)	PC x ET x CW x CF
	EF	Exposure Frequency	days/year	58	USEPA, 2011 (3)	29	USEPA, 2011 (3)	
	ED	Exposure Duration	years	10	USEPA, 2018 (4)	10	USEPA, 2018 (4)	DAevent (mg/cm^2-event) - Organics=
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	ET <= t* =
	AT-C	Averaging Time (cancer)	days	25550	USEPA, 1989	25550	USEPA, 1989	2 x FA x PC x CW x CF x SQRT(6 x tevent x ET / PI)
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	3,650	USEPA, 1989	3,650	USEPA, 1989	ET > t* =
	FA	Fraction Absorbed	unitless	chemical-specific	Refer to Table 4.20	chemical-specific	Refer to Table 4.20	FA x PC x CW x CFx (ET/(1+B)+2 x tevent x ((1+3B+$3B^2$)/(1+B)^2)
	PC	Permeability Constant	cm/hour	chemical-specific	Refer to Table 4.20	chemical-specific	Refer to Table 4.20	t* =2.4 x tevent
	tevent	Lag Time per event	hr/event	chemical specific	Refer to Table 4.20	chemical specific	Refer to Table 4.20	
	B	Constant	dimensionless	chemical specific	Refer to Table 4.20	chemical specific	Refer to Table 4.20	

Table 4.19

Values Used for Daily Intake Calculations - Trespasser Exposure Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Water
Exposure Medium: Surface Water
Receptor Population: Trespasser
Receptor Age: Adolescent

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CW	Chemical Concentration in Ambient Air	mg/m^3	not applicable	(6)	not applicable	(6)	Exposure Concentration (EC) (mg/m^3) =
	FT	Fraction Time Exposed	unitless	1/24	USEPA, 2011 (2)	0.5/24	USEPA, 2011 (2)	CAA x FT x EF x ED x 1/AT
	EF	Exposure Frequency	days/year	58	USEPA, 2011 (3)	29	USEPA, 2011 (3)	
	ED - adult	Exposure Duration	years	10	USEPA, 2018 (4)	10	USEPA, 2018 (4)	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N (adult)	Averaging Time (non-cancer) (ED x 365 days/year)	days	3,650	USEPA, 1989	3,650	USEPA, 1989	

Notes:

(1) For surface water concentrations, refer to Table 3.42.

(2) RME exposure time is based on half of the 95th percentile playing on sand/gravel or grass of 121 minutes per day [(121 minutes per day/60 minutes per hour)/ 2] (USEPA, 2011, Table 16-1. Recommended Values for Activity Patterns). The CT is half the RME.

(3) The basis for the EF is the average of the mean time spent outdoors for the age groups 6-11 and 11-16 from Table 16-1, Recommended Values for Activity Factors - Time Outdoors (total).
For 6-11 years old, the time spent outdoors of 132 min/day equals an exposure frequency of 33 days/year [(132 min/d /1440 total min/d)*365].
For 11-16 years old, the time spent outdoors of 100 min/day equals an exposure frequency of 25 days/year [(100 min/d /1440 total min/d)*365].
The average of the age groups 6-11 and 11-16 of 29 days/year is a central tendency value that was doubled to 58 days/year to derive the RME value.

(4) Trespasser is a 7 through 16 year old therefore the exposure duration is 10 years, based on USEPA (2018).

(5) The basis for SA is the average value for age groups 6 to 11 and 11 to 16 and calculated by summing the mean surface area by body part for face, lower arms, lower legs, feet, and hands from Table 7-2, Recommended Values for Surface Area of Body Parts, Males and Female Children Combined. The surface area of the face was assumed to be one-third the surface area of the head, the surface area of the lower legs was assumed to be 40 percent of the

(6) Not applicable; chemicals of potential concern are not considered to be volatile and therefore pathway is incomplete.

References:

USEPA, 1989: Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989.

USEPA, 2011: Exposure Factors Handbook 2011 Edition (Final). U.S. Environmental Protection Agency, Washington, DC, EPA/600/R-09/052F, September 2011.

USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

USEPA, 2018: Region 4 Human Health Risk Assessment Bulletins Supplemental Guidance, Section 4.2.2 Trespasser Scenario, March 2018 Update.

USEPA, 2019: Regional Screening Levels (RSLs) User's Guide, November 2019.

Table 4.20

Derivation of DAevent for Surface Water - Recreational User Dermal Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

DAevent (cm/event) [(1)] - Inorganics= PC x ET

Chemical of Potential Concern	PC cm/hr	Ref	CT ET hr/event	CT DAevent [(1)] cm/event	RME ET hr/event	RME DAevent [(1)] cm/event
Metals						
Arsenic	1.00E-03	USEPA, 2004	5.0E-01	5.0E-04	1.0E+00	1.00E-03
Manganese	1.00E-03	USEPA, 2004	5.0E-01	5.0E-04	1.0E+00	1.00E-03
Thallium	1.00E-03	USEPA, 2004	5.0E-01	5.0E-04	1.0E+00	1.00E-03

Note:

(1) DAevent calculated consistent with USEPA (2004) equation.

Reference:

USEPA, 2004: RAGs Volume 1, Human Health Evaluation Manual,
Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.

Table 4.21

Values Used for Daily Intake Calculations - Construction/Utility Worker Exposure to Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Water
Exposure Medium: Surface Water
Receptor Population: Construction/Utility Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CW	Chemical Concentration in Groundwater	mg/L	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR	Ingestion Rate	L/hour	0.005	USEPA, 1989 (2)	0.005	USEPA, 1989 (2)	CW x IR x ET x EF x ED x 1/BW x 1/AT
	ET	Exposure Time	hour/day	1	(3)	1	(3)	
	EF	Exposure Frequency	days/year	10	(4)	5	(4)	
	ED	Exposure Duration	years	1	USEPA, 2002	1	USEPA, 2002	
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	365	USEPA, 1989	365	USEPA, 1989	
Dermal	CW	Chemical Concentration in Groundwater	mg/L	(1)	(1)	(1)	(1)	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2	3,527	USEPA, 2014	3,527	USEPA, 2014	DAevent x SA x EF x EV x ED x 1/BW x 1/AT
	CF	Conversion Factor	L/cm^3	1.00E-03	--	1.00E-03	--	
	EV	Event Frequency	event/day	1	USEPA, 2004	1	USEPA, 2004	DAevent (mg/cm^2-event) - Inorganics=
	ET	Exposure Time	hour/event	1	(3)	1	(3)	PC x ET x CW x CF
	EF	Exposure Frequency	days/year	10	(4)	5	(4)	
	ED	Exposure Duration	years	1	USEPA, 2002	1	USEPA, 2002	DAevent (mg/cm^2-event) - Organics=
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	ET <= t* =
	AT-C	Averaging Time (cancer)	days	25550	USEPA, 1989	25550	USEPA, 1989	2 x FA x PC x CW x CF x SQRT(6 x tevent x ET / PI)
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	365	USEPA, 1989	365	USEPA, 1989	ET > t* =
	FA	Fraction Absorbed	unitless	chemical-specific	Refer to Table 4.22	chemical-specific	Refer to Table 4.22	FA x PC x CW x CFx (ET/(1+B)+2 x tevent x ((1+3B+$3B^2$)/(1+B)^2)
	PC	Permeability Constant	cm/hour	chemical-specific	Refer to Table 4.22	chemical-specific	Refer to Table 4.22	t* =2.4 x tevent
	tevent	Lag Time per event	hr/event	chemical specific	Refer to Table 4.22	chemical specific	Refer to Table 4.22	
	B	Constant	dimensionless	chemical specific	Refer to Table 4.22	chemical specific	Refer to Table 4.22	

Table 4.21

Values Used for Daily Intake Calculations - Construction/Utility Worker Exposure to Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Surface Water
Exposure Medium: Surface Water
Receptor Population: Construction/Utility Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CAA	Chemical Concentration in Ambient Air	mg/m^3	not applicable	(5)	not applicable	(5)	Exposure Concentration (EC) (mg/m^3) = CAA x FT x EF x ED x 1/AT

Notes:

(1) For surface water concentrations, refer to Table 3.42.
(2) An incidental surface water ingestion rate of 50 mL/hour, specified in Risk Assessment Guidance for Superfund Part A (USEPA, 1989), represents the incidental water ingestion rate for an adult while swimming.
Because the worker will not be swimming , but instead may have only occasional limited contact, a factor of 10 was applied to arrive at the incidental ingestion rate of 0.005 L/hr.
(3) Assumes a construction/utility worker is in direct contact with the medium for a limited time (1 hour/day) spent on the Site.
(4) Assumes a construction/utility worker conducts installations and/or repairs/maintenance for 5 days/year for CT and 10 days/year for the RME.
(5) Chemicals of potential concern (COPCs) are consider not volaitle therefore pathway is incomplete.

References:

USEPA, 1989: Risk Assessment Guidance for Superfund. Vol. 1: Human Health Evaluation Manual, Part A OERR. EPA/540-1-89-002.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.
USEPA, 2004: RAGs Volume 1, Human Health Evaluation Manual, Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

Table 4.22

Derivation of DAevent for Surface Water - Construction/Utility Worker Dermal Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

DAevent (cm/event) [(1)] - Inorganics= PC x ET

Chemical of Potential Concern	PC cm/hr	Ref	CT/ RME ET hr/event	CT/ RME DAevent [(1)] cm/event
Metals				
Arsenic	1.00E-03	USEPA, 2004	1.0E+00	1.0E-03
Manganese	1.00E-03	USEPA, 2004	1.0E+00	1.0E-03
Mercury	1.00E-03	USEPA, 2004	1.0E+00	1.0E-03

Note:

(1) DAevent calculated consistent with USEPA (2004) equation.

Reference:

USEPA, 2004: RAGs Volume 1, Human Health Evaluation Manual,
Part E: Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.

Table 4.23

Values Used for Daily Intake Calculations - Maintanence/Outdoor Worker Exposure to Floodplain Surface Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil
Receptor Population: Maintanence/Outdoor Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Ingestion	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Chronic Daily Intake (CDI) (mg/kg-day) =
	IR	Ingestion Rate of Soil	mg soil/ day	100	USEPA, 2014	100	USEPA, 2014	CS x IR x CF x ABS x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	
	EF	Exposure Frequency	days/year	32	(2)	16	(2)	
	ED	Exposure Duration	years	25	USEPA, 2014	9	USEPA, 2004	
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	9,125	USEPA, 1989	3,285	USEPA, 1989	
	ABS	Absorption Factor	%/100	chemical-specific	USEPA, 2012 (3)	chemical-specific	USEPA, 2012 (3)	
Dermal	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	CDI (mg/kg-day) =
	SA	Skin Surface Area Available for Contact	cm^2	3,527	USEPA, 2014	3,527	USEPA, 2014	CS x CF x SA x AF x ABS x EF x ED x 1/BW x 1/AT
	CF	Conversion Factor	kg/mg	1.0E-06	--	1.0E-06	--	
	EF	Exposure Frequency	days/year	32	(2)	16	(2)	
	ED	Exposure Duration	years	25	USEPA, 2014	9	USEPA, 2004	
	BW	Body Weight	kg	80	USEPA, 2014	80	USEPA, 2014	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year)	days	9,125	USEPA, 1989	3,285	USEPA, 1989	
	AF	Soil to Skin Adherence Factor	mg/cm^2	0.12	USEPA, 2014	0.02	USEPA, 2004	
	ABS	Absorption Factor	%/100	chemical-specific	(4)	chemical-specific	(4)	

Table 4.23

Values Used for Daily Intake Calculations - Maintanence/Outdoor Worker Exposure to Floodplain Surface Soil
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Medium: Floodplain Surface Soil (0-2 ft BGS)
Exposure Medium: Surface Soil
Receptor Population: Maintanence/Outdoor Worker
Receptor Age: Adult

Exposure Route	Parameter Code	Parameter Definition	Units	RME Value	RME Rationale/ Reference	CT Value	CT Rationale/ Reference	Intake Equation/ Model Name
Inhalation	CS	Chemical Concentration in Soil	mg/kg	(1)	(1)	(1)	(1)	Exposure Concentration (EC) (mg/m^3) =
	ET	Exposure Time	unitless	8/24	USEPA, 2014	8/24	USEPA, 2014	CS x ET x EF x ED x 1/(PEF + VF) x 1/AT
	EF	Exposure Frequency	days/year	32	(2)	16	(2)	
	ED	Exposure Duration	years	25	USEPA, 2014	9	USEPA, 2004	
	AT-C	Averaging Time (cancer)	days	25,550	USEPA, 1989	25,550	USEPA, 1989	
	AT-N	Averaging Time (non-cancer) (ED x 365 days/year	days	9,125	USEPA, 1989	3,285	USEPA, 1989	
	PEF	Particulate Emission Factor	m^3/kg	1.36E+09	USEPA, 2002	1.36E+09	USEPA, 2002	
	VF	Volatilization Factor	m^3/kg	chemical-specific	Refer to Table 4.6	chemical-specific	Refer to Table 4.6	

Notes:

(1) For surface soil and soil concentrations, refer to each exposure unit (EU) for EPCs.
(2) Professional Judgement; based on cutting grass 1 day/week for the months of April through to October. CTE is half the RME value.
(3) Current default assumption of 100% with the exception of arsenic at 60%.
(4) USEPA 2004 Exhibit 3-4 and metals of 1% as recommeded by Region 3 Technical Guidance Manual, Risk Assessment https://www.epa.gov/risk/assessing-dermal-exposure-soil

References:

USEPA, 1989: Risk Assessment Guidance for Superfund (RAGS): Volume 1 – Human Health Evaluation Manual (Part A), Interim Final, EPA/540/1-89/002, December 1989.
USEPA, 2002: Supplemental Guidance for Developing Soil Screening Levels for Superfund Sites, OSWER 9355.4-24, December 2002.
USEPA, 2004: Risk Assessment Guidance for Superfund (RAGS):Volume 1 - Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment), EPA/540/R/99/005, July 2004.
USEPA, 2012: Recommendations for Default Value for Relative Bioavailability of Arsenic in Soil, OSWER 9200.1-113, December 2012.
USEPA, 2014: Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors, OSWER Directive 9200.1-120, February 2014.

Table 5.1

Non-Cancer Toxicity Data - Oral/Dermal Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source of RFC	Date of RfC (3) (MM-YY)
VOCs										
1,1-Dichloroethane	chronic	2.00E-01	mg/kg-d	100%	2.00E-01	mg/kg-d	kidney	3000	PPRTV	Sep-06
1,2,4-Trichlorobenzene	chronic	1.00E-02	mg/kg-d	100%	1.00E-02	mg/kg-d	endocrine	1000	IRIS	May-92
1,2-Dibromo-3-chloropropane (DBCP)	chronic	2.00E-04	mg/kg-d	100%	2.00E-04	mg/kg-d	reproductive effects	3000	PPRTV	Aug-06
1,2-Dichloroethane	chronic	6.00E-03	mg/kg-d	100%	6.00E-03	mg/kg-d	kidney	10000	PPRTV	Oct-10
1,4-Dichlorobenzene	chronic	7.00E-02	mg/kg-d	100%	7.00E-02	mg/kg-d	liver	100	ATSDR	Aug-06
1,4-Dioxane	chronic	3.00E-02	mg/kg-d	100%	3.00E-02	mg/kg-d	liver	300	IRIS	Aug-10
Benzene	chronic	4.00E-03	mg/kg-d	100%	4.00E-03	mg/kg-d	immune system	300	IRIS	Apr-03
Bromodichloromethane	chronic	2.00E-02	mg/kg-d	100%	2.00E-02	mg/kg-d	urinary tract	1000	IRIS	Sep-87
Carbon tetrachloride	chronic	4.00E-03	mg/kg-d	100%	4.00E-03	mg/kg-d	liver	1000	IRIS	Mar-10
Chlorobenzene	chronic	2.00E-02	mg/kg-d	100%	2.00E-02	mg/kg-d	liver	1000	IRIS	Aug-89
Chloroform (Trichloromethane)	chronic	1.00E-02	mg/kg-d	100%	1.00E-02	mg/kg-d	liver	100	IRIS	Oct-01
cis-1,2-Dichloroethene	chronic	2.00E-03	mg/kg-d	100%	2.00E-03	mg/kg-d	urinary tract	3000	IRIS	Sep-10
Ethylbenzene	chronic	1.00E-01	mg/kg-d	100%	1.00E-01	mg/kg-d	liver	1000	IRIS	Jun-91
Methylene chloride	chronic	6.00E-03	mg/kg-d	100%	6.00E-03	mg/kg-d	liver	30	IRIS	Nov-11
Tetrachloroethene	chronic	6.00E-03	mg/kg-d	100%	6.00E-03	mg/kg-d	central nervous system	1	IRIS	Feb-12
Toluene	chronic	8.00E-02	mg/kg-d	100%	8.00E-02	mg/kg-d	urinary tract	3000	IRIS	Sep-05
Trichloroethene	chronic	5.00E-04	mg/kg-d	100%	5.00E-04	mg/kg-d	developmental effects	1	IRIS	Sep-11
Vinyl chloride	chronic	3.00E-03	mg/kg-d	100%	3.00E-03	mg/kg-d	liver	30	IRIS	Aug-00
Xylenes (total)	chronic	2.00E-01	mg/kg-d	100%	2.00E-01	mg/kg-d	body weight, mortality	1000	IRIS	Feb-03
SVOCs										
Acenaphthene	chronic	6.00E-02	mg/kg-d	100%	6.00E-02	mg/kg-d	liver	3000	IRIS	Apr-94
Acenaphthylene (4)	chronic	6.00E-02	mg/kg-d	100%	6.00E-02	mg/kg-d	liver	3000	IRIS	Apr-94
Anthracene	chronic	3.00E-01	mg/kg-d	100%	3.00E-01	mg/kg-d	no effects	3000	IRIS	Jul-93
Benzo(a)anthracene	--	--	--	--	--	--	--	--	--	--
Benzo(a)pyrene	chronic	3.00E-04	mg/kg-d	100%	3.00E-04	mg/kg-d	central nervous system	300	IRIS	Jan-17
Benzo(b)fluoranthene	--	--	--	--	--	--	--	--	--	--
Benzo(g,h,i)perylene (4)	chronic	3.00E-02	mg/kg-d	100%	3.00E-02	mg/kg-d	kidney	3000	IRIS	Sep-94
Benzo(k)fluoranthene	--	--	--	--	--	--	--	--	--	--

Table 5.1

Non-Cancer Toxicity Data - Oral/Dermal Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source of RFC	Date of RfC (3) (MM-YY)
SVOCs (cont.'d)										
Biphenyl (1,1'-Biphenyl)	chronic	5.00E-01	mg/kg-d	100%	5.00E-01	mg/kg-d	kidney	30	IRIS	Aug-13
bis(2-Ethylhexyl)phthalate (DEHP)	chronic	2.00E-02	mg/kg-d	100%	2.00E-02	mg/kg-d	liver	1000	IRIS	Jan-87
Carbazole	--	--	--	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--	--	--	--
Dibenzofuran	chronic	1.00E-03	mg/kg-d	100%	1.00E-03	mg/kg-d	growth	10000	PPRTV	Jun-07
Fluoranthene	chronic	4.00E-02	mg/kg-d	100%	4.00E-02	mg/kg-d	liver	3000	IRIS	Jul-93
Fluorene	chronic	4.00E-02	mg/kg-d	100%	4.00E-02	mg/kg-d	blood system	3000	IRIS	Nov-90
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	--	--	--	--
Naphthalene	chronic	2.00E-02	mg/kg-d	100%	2.00E-02	mg/kg-d	body weight	3000	IRIS	Sep-98
Phenanthrene (4)	chronic	3.00E-02	mg/kg-d	100%	3.00E-02	mg/kg-d	kidney	3000	IRIS	Sep-94
Pyrene	chronic	3.00E-02	mg/kg-d	100%	3.00E-02	mg/kg-d	kidney	3000	IRIS	Sep-94
Metals										
Aluminum	chronic	1.00E+00	mg/kg-d	100%	1.00E+00	mg/kg-d	central nervous system	100	PPRTV	Oct-06
Antimony	chronic	4.00E-04	mg/kg-d	15%	6.00E-05	mg/kg-d	clinical serum chemistry	1000	IRIS	Feb-91
Arsenic	chronic	3.00E-04	mg/kg-d	100%	3.00E-04	mg/kg-d	skin	3	IRIS	Feb-93
Barium	chronic	2.00E-01	mg/kg-d	7%	1.40E-02	mg/kg-d	kidney	300	IRIS	Jul-05
Beryllium	chronic	2.00E-03	mg/kg-d	100%	2.00E-03	mg/kg-d	gastrointestinal effects	300	IRIS	Apr-98
Cadmium (diet/soil)	chronic	1.00E-03	mg/kg-d	5%	5.00E-05	mg/kg-d	kidney	10	IRIS	Feb-94
Cadmium (water)	chronic	5.00E-04	mg/kg-d	5%	2.50E-05	mg/kg-d	kidney	10	IRIS	Feb-94
Chromium	chronic	1.50E+00	mg/kg-d	1.3%	1.95E-02	mg/kg-d	no effects	100	IRIS	Sep-98
Chromium VI	chronic	3.00E-03	mg/kg-d	100%	3.00E-03	mg/kg-d	no effects	900	IRIS	Sep-98
Cobalt	chronic	3.00E-04	mg/kg-d	100%	3.00E-04	mg/kg-d	thyroid effects	3000	PPRTV	Aug-08
Copper	chronic	4.00E-02	mg/kg-d	100%	4.00E-02	mg/kg-d	--	--	HEAST	Dec-11
Cyanide	chronic	6.00E-04	mg/kg-d	100%	6.00E-04	mg/kg-d	reproductive effects	3000	IRIS	Sep-10
Iron	chronic	7.00E-01	mg/kg-d	100%	7.00E-01	mg/kg-d	gastrointestinal effects	1.5	PPRTV	Sep-06
Lead	--	--	--	--	--	--	--	--	--	--
Manganese (diet)	chronic	1.40E-01	mg/kg-d	--	--	--	central nervous system	1	IRIS	Nov-95

Table 5.1

Non-Cancer Toxicity Data - Oral/Dermal Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source of RFC	Date of RfC (3) (MM-YY)
Metals (cont.'d)										
Manganese (non-diet)	chronic	2.40E-02	mg/kg-d	4%	9.60E-04	mg/kg-d	central nervous system	3	IRIS	May-96
Mercury	chronic	3.00E-04	mg/kg-d	100%	3.00E-04	mg/kg-d	immune system	1000	IRIS	May-95
Methyl mercury	chronic	1.00E-03	mg/kg-d	100%	1.00E-03	mg/kg-d	developmental effects	1	IRIS	Jul-01
Nickel	chronic	2.00E-02	mg/kg-d	4%	8.00E-04	mg/kg-d	body weight	300	IRIS	Dec-96
Selenium	chronic	5.00E-03	mg/kg-d	100%	5.00E-03	mg/kg-d	clinical selenosis	3	IRIS	Sep-91
Silver	chronic	5.00E-03	mg/kg-d	4%	2.00E-04	mg/kg-d	skin (argyria)	3	IRIS	Dec-96
Thallium	chronic	1.00E-05	mg/kg-d	100%	1.00E-05	mg/kg-d	hair follicle atrophy	3000	PPRTV	Nov-12
Vanadium	chronic	5.00E-03	mg/kg-d	2.6%	1.30E-04	mg/kg-d	biochemical	100	IRIS	Jun-98
Zinc	chronic	3.00E-01	mg/kg-d	100%	3.00E-01	mg/kg-d	blood system	3	IRIS	Aug-05
PCBs										
Aroclor-1232 (PCB-1232)	--	--	--	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	--	--	--	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	--	--	--	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	chronic	2.00E-05	mg/kg-d	100%	2.00E-05	mg/kg-d	immune system	300	IRIS	Nov-96
Aroclor-1260 (PCB-1260)	--	--	--	--	--	--	--	--	--	--
Pesticides										
Chlordane	chronic	5.00E-04	mg/kg-d	100%	5.00E-04	mg/kg-d	liver	300	IRIS	Feb-98
Dieldrin	chronic	5.00E-05	mg/kg-d	100%	5.00E-05	mg/kg-d	liver	100	IRIS	Sep-90
Heptachlor epoxide	chronic	1.30E-05	mg/kg-d	100%	1.30E-05	mg/kg-d	liver	1000	IRIS	Mar-91
Dioxin/Furan										
Total TEQ	chronic	7.00E-10	mg/kg-d	100%	7.00E-10	mg/kg-d	reproductive effects	30	IRIS	Feb-12

Table 5.1

Non-Cancer Toxicity Data - Oral/Dermal Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Chronic/ Subchronic	Oral RfD Value	Oral RfD Units	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal RfD (2)	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source of RFC	Date of RfC (3) (MM-YY)
Asbestos										
Chrysotile asbestos	--	--	--	--	--	--	--	--	--	--

Notes:

-- = Not Available

(1) USEPA, Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual, Part E Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.

(2) Adjusted Dermal RfD = Oral RfD x Oral to Dermal Adjustment Factor

(3) Integrated Risk Information System (IRIS) Database, accessed November 2019.

Note: dates of RfD provided is the last revision date of the IRIS toxicity data provided (http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList).

Note: the oral RfD toxicity value for vanadium is derived from the IRIS oral RfD for vanadium pentoxide by factoring out the molecular weight of the oxide ion.

Provisional Peer Reviewed Toxicity Values (PPRTV) Database, accessed November 2019.

Note: dates of RfD provided is the last revision date of the PPRTV toxicity data provided (https://hhpprtv.ornl.gov/).

Agency for Toxic Substances and Disease Registry (ATSDR) Database, accessed November 2019.

Note: dates of RfD provided is the last revision date of the ATSDR toxicity data provided (http://www.atsdr.cdc.gov).

HEAST, 2011: Health Effects Assessment Summary Tables (HEAST), On-line Repository, December 2011.

(4) No toxicity data available, surrogate toxicity data implemented as follows:

Chemical		Surrogate
acenaphthylene	-	acenaphthene
benzo(g,h,i)perylene	-	pyrene
phenanthrene	-	pyrene

Table 5.2

Non-Cancer Toxicity Data - Inhalation Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source of RFC	Date of RfC (1) (MM-YY)
VOCs							
1,1-Dichloroethane	--	--	--	--	--	--	--
1,2,4-Trichlorobenzene	chronic	2.00E-03	mg/m^3	increased urinary excretion of porphyrins	3000	PPRTV	Jun-09
1,2-Dibromo-3-chloropropane (DBCP)	chronic	2.00E-04	mg/m^3	reproductive effects	1000	IRIS	Oct-91
1,2-Dichloroethane	chronic	7.00E-03	mg/m^3	liver	3000	PPRTV	Oct-10
1,4-Dichlorobenzene	chronic	8.00E-01	mg/m^3	liver	100	IRIS	Jan-94
1,4-Dioxane	chronic	3.00E-02	mg/m^3	respiratory effects	1000	IRIS	Sep-13
Benzene	chronic	3.00E-02	mg/m^3	immune system	300	IRIS	Apr-03
Bromodichloromethane	--	--	--	--	--	--	--
Carbon tetrachloride	chronic	1.00E-01	mg/m^3	liver	100	IRIS	Mar-10
Chlorobenzene	chronic	5.00E-02	mg/m^3	kidney	10	PPRTV	Oct-06
Chloroform (Trichloromethane)	chronic	9.80E-02	mg/m^3	kidney	100	ATSDR	Sep-97
cis-1,2-Dichloroethene	--	--	--	--	--	--	--
Ethylbenzene	chronic	1.00E+00	mg/m^3	developmental effects	300	IRIS	Mar-91
Methylene chloride	chronic	6.00E-01	mg/m^3	liver	30	IRIS	Nov-11
Tetrachloroethene	chronic	4.00E-02	mg/m^3	central nervous system	1	IRIS	Feb-12
Toluene	chronic	5.00E+00	mg/m^3	central nervous system	10	IRIS	Sep-05
Trichloroethene	chronic	2.00E-03	mg/m^3	developmental effects	1	IRIS	Sep-11
Vinyl chloride	chronic	1.00E-01	mg/m^3	liver	30	IRIS	Aug-00
Xylenes (total)	chronic	1.00E-01	mg/m^3	central nervous system	300	IRIS	Feb-03
SVOCs							
Acenaphthene	--	--	--	--	--	--	--
Acenaphthylene	--	--	--	--	--	--	--
Anthracene	--	--	--	--	--	--	--
Benzo(a)anthracene	--	--	--	--	--	--	--
Benzo(a)pyrene	chronic	2.00E-06	mg/m^3	developmental effects	3000	IRIS	Jan-17
Benzo(b)fluoranthene	--	--	--	--	--	--	--

Table 5.2

Non-Cancer Toxicity Data - Inhalation Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source of RFC	Date of RfC (1) (MM-YY)
SVOCs (cont.'d)							
Benzo(g,h,i)perylene	--	--	--	--	--	--	--
Benzo(k)fluoranthene	--	--	--	--	--	--	--
Biphenyl (1,1'-Biphenyl)	chronic	4.00E-04	mg/m^3	respiratory system	3000	PPRTV	Apr-11
bis(2-Ethylhexyl)phthalate (DEHP)	--	--	--	--	--	--	--
Carbazole	--	--	--	--	--	--	--
Chrysene	--	--	--	--	--	--	--
Dibenz(a,h)anthracene	--	--	--	--	--	--	--
Dibenzofuran	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	--	--	--
Fluorene	--	--	--	--	--	--	--
Indeno(1,2,3-cd)pyrene	--	--	--	--	--	--	--
Naphthalene	chronic	3.00E-03	mg/m^3	respiratory system	3000	IRIS	Sep-98
Phenanthrene	--	--	--	--	--	--	--
Pyrene	--	--	--	--	--	--	--
Metals							
Aluminum	chronic	5.00E-03	mg/m^3	neurotoxicity	300	PPRTV	Oct-06
Antimony	--	--	--	--	--	--	--
Arsenic	chronic	1.50E-05	mg/m^3	neurodevelopmental	30	CalEPA	Jul-14
Barium	chronic	5.00E-04	mg/m^3	developmental effects	1000	HEAST	Dec-11
Beryllium	chronic	2.00E-05	mg/m^3	immune system	10	IRIS	Apr-98
Cadmium	chronic	1.00E-05	mg/m^3	renal effects	3	ATSDR	Sep-12
Chromium	--	--	--	--	--	--	--
Chromium VI	chronic	1.00E-04	mg/m^3	respiratory system	1	IRIS	Sep-98
Cobalt	chronic	6.00E-06	mg/m^3	respiratory system	300	PPRTV	Aug-08
Copper	--	--	--	--	--	--	--
Cyanide	chronic	8.00E-04	mg/m^3	thyroid	3000	IRIS	Sep-10

Table 5.2

Non-Cancer Toxicity Data - Inhalation Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source of RFC	Date of RfC (1) (MM-YY)
Metals (cont.'d)							
Iron	--	--	--	--	--	--	--
Lead	--	--	--	--	--	--	--
Manganese (diet)	--	--	--	--	--	--	--
Manganese (non-diet)	chronic	5.00E-05	mg/m^3	central nervous system	1000	IRIS	Dec-93
Mercury	chronic	3.00E-04	mg/m^3	central nervous system	30	IRIS	Jun-95
Methyl mercury	--	--	--	--	--	--	--
Nickel	chronic	9.00E-05	mg/m^3	respiratory system	30	ATSDR	Aug-05
Selenium	chronic	2.00E-02	mg/m^3	clinicial selenosis	3	CalEPA	Dec-01
Silver	--	--	--	--	--	--	--
Thallium	--	--	--	--	--	--	--
Vanadium	chronic	1.00E-04	mg/m^3	respiratory system	30	ATSDR	Sep-12
Zinc	--	--	--	--	--	--	--
PCBs							
Aroclor-1232 (PCB-1232)	--	--	--	--	--	--	--
Aroclor-1242 (PCB-1242)	--	--	--	--	--	--	--
Aroclor-1248 (PCB-1248)	--	--	--	--	--	--	--
Aroclor-1254 (PCB-1254)	--	--	--	--	--	--	--
Aroclor-1260 (PCB-1260)	--	--	--	--	--	--	--
Pesticides							
Chlordane	chronic	7.00E-04	mg/m^3	liver	1000	IRIS	Feb-98
Dieldrin	--	--	--	--	--	--	--
Heptachlor epoxide	--	--	--	--	--	--	--
Dioxin/Furan							
Total TEQ	chronic	4.00E-08	mg/m^3	mortality; growth; hematologic system; biochemical; liver and lung lesions	100	CalEPA	Dec-08

Table 5.2

Non-Cancer Toxicity Data - Inhalation Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Chronic/ Subchronic	Value Inhalation RfC	Units	Primary Target Organ	Combined Uncertainty/Modifying Factors	Source of RFC	Date of RfC (1) (MM-YY)
Asbestos							
Chrysotile asbestos	--	--	--	--	--	--	--

Notes:

-- = Not Available

(1) Integrated Risk Information System (IRIS) Database, accessed November 2019.
Note: dates of RfC provided is the last revision date of the IRIS toxicity data provided (http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList).
Agency for Toxic Substances and Disease Registry (ATSDR) Database, accessed November 2019.
Note: dates of RfC provided is the last revision date of the ATSDR toxicity data provided (http://www.atsdr.cdc.gov).
CalEPA, 2014: California Office of Environmental Health Hazard Assessment, Chronic Reference Exposure Levels (RELs).
Note: dates of RfC provided is the last revision date
Provisional Peer Reviewed Toxicity Values (PPRTV) Database, accessed November 2019.
Note: dates of RfC provided is the last revision date of the PPRTV toxicity data provided (https://hhpprtv.ornl.gov/).
HEAST, 2011: Health Effects Assessment Summary Tables (HEAST), On-line Repository, December 2011.

Table 6.1

Cancer Toxicity Data - Oral/Dermal Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence/ Cancer Guideline Description	Source of CSF	Date of CSF (3) (MM-YY)
VOCs							
1,1-Dichloroethane	5.70E-03	100%	5.70E-03	$(mg/kg\text{-}day)^{-1}$	Possible human carcinogen	CalEPA	May-19
1,2,4-Trichlorobenzene	2.90E-02	100%	2.90E-02	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	PPRTV	Jun-09
1,2-Dibromo-3-chloropropane (DBCP)	8.00E-01	100%	8.00E-01	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	PPRTV	Aug-06
1,2-Dichloroethane	9.10E-02	100%	9.10E-02	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Mar-87
1,4-Dichlorobenzene	5.40E-03	100%	5.40E-03	$(mg/kg\text{-}day)^{-1}$	--	OEHHA	Jan-11
1,4-Dioxane	1.00E-01	100%	1.00E-01	$(mg/kg\text{-}day)^{-1}$	Likely to be carcinogenic to humans	IRIS	Sep-13
Benzene	5.50E-02	100%	5.50E-02	$(mg/kg\text{-}day)^{-1}$	Known human carcinogen	IRIS	Jan-00
Bromodichloromethane	6.20E-02	100%	6.20E-02	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Feb-93
Carbon tetrachloride	7.00E-02	100%	7.00E-02	$(mg/kg\text{-}day)^{-1}$	Likely to be carcinogenic to humans	IRIS	Mar-10
Chlorobenzene	--	--	--	--	--	--	--
Chloroform (Trichloromethane)	3.10E-02	100%	3.10E-02	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	OEHHA	Jan-11
cis-1,2-Dichloroethene	--	--	--	--	--	--	--
Ethylbenzene	1.10E-02	100%	1.10E-02	$(mg/kg\text{-}day)^{-1}$	Not classifiable as a human carcinogen	CalEPA	May-19
Methylene chloride	2.00E-03	100%	2.00E-03	$(mg/kg\text{-}day)^{-1}$	Likely to be carcinogenic to humans	IRIS	Nov-11
Tetrachloroethene	2.10E-03	100%	2.10E-03	$(mg/kg\text{-}day)^{-1}$	Likely to be carcinogenic to humans	IRIS	Feb-12
Toluene	--	--	--	--	--	--	--
Trichloroethene	4.60E-02	100%	4.60E-02	$(mg/kg\text{-}day)^{-1}$	Known human carcinogen	IRIS	Sep-11
Vinyl chloride - lifetime	1.40E+00	100%	1.40E+00	$(mg/kg\text{-}day)^{-1}$	Known human carcinogen	IRIS	Aug-00
Vinyl chloride - adulthood	7.20E-01	100%	7.20E-01	$(mg/kg\text{-}day)^{-1}$	Known human carcinogen	IRIS	Aug-00
Xylenes (total)	--	--	--	--	--	--	--
SVOCs							
Acenaphthene	--	--	--	--	--	--	--
Acenaphthylene	--	--	--	--	Not classifiable as a human carcinogen	--	--
Anthracene	--	--	--	--	Not classifiable as a human carcinogen	--	--
Benzo(a)anthracene	1.00E-01	100%	1.00E-01	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Benzo(a)pyrene	1.00E+00	100%	1.00E+00	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Benzo(b)fluoranthene	1.00E-01	100%	1.00E-01	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17

Table 6.1

Cancer Toxicity Data - Oral/Dermal Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence/ Cancer Guideline Description	Source of CSF	Date of CSF (3) (MM-YY)
SVOCs (cont.'d)							
Benzo(g,h,i)perylene	--	--	--	--	Not classifiable as a human carcinogen	--	--
Benzo(k)fluoranthene	1.00E-02	100%	1.00E-02	(mg/kg-day) $^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Biphenyl (1,1'-Biphenyl)	8.00E-03	100%	8.00E-03	(mg/kg-day) $^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Aug-13
bis(2-Ethylhexyl)phthalate (DEHP)	1.40E-02	100%	1.40E-02	(mg/kg-day) $^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Sep-88
Carbazole	--	--	--	--	--	--	--
Chrysene	1.00E-03	100%	1.00E-03	(mg/kg-day) $^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Dibenz(a,h)anthracene	1.00E+00	100%	1.00E+00	(mg/kg-day) $^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Dibenzofuran	--	--	--	--	--	--	--
Fluoranthene	--	--	--	--	Not classifiable as a human carcinogen	--	--
Fluorene	--	--	--	--	Not classifiable as a human carcinogen	--	--
Indeno(1,2,3-cd)pyrene	1.00E-01	100%	1.00E-01	(mg/kg-day) $^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Naphthalene	--	--	--	--	--	--	--
Phenanthrene	--	--	--	--	Not classifiable as a human carcinogen	--	--
Pyrene	--	--	--	--	Not classifiable as a human carcinogen	--	--
Metals							
Aluminum	--	--	--	--	--	--	--
Antimony	--	--	--	--	--	--	--
Arsenic	1.50E+00	100%	1.50E+00	(mg/kg-day) $^{-1}$	Known human carcinogen	IRIS	Apr-98
Barium	--	--	--	--	Not classifiable as a human carcinogen	--	--
Beryllium	--	--	--	--	--	--	--
Cadmium	--	--	--	--	Probable human carcinogen - sufficient evidence in humans	--	--
Chromium	--	--	--	--	Not classifiable as a human carcinogen	--	--
Chromium VI	5.00E-01	100%	5.00E-01	(mg/kg-day) $^{-1}$	Known human carcinogen	OEHHA	Jul-11
Cobalt	--	--	--	--	--	--	--
Copper	--	--	--	--	--	--	--
Cyanide	--	--	--	--	Not classifiable as a human carcinogen	--	--

Table 6.1

Cancer Toxicity Data - Oral/Dermal Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence/ Cancer Guideline Description	Source of CSF	Date of CSF (3) (MM-YY)
Metals (cont.'d)							
Iron	--	--	--	--	--	--	--
Lead	--	--	--	--	Probable human carcinogen - sufficient evidence in animals	--	--
Manganese (diet)	--	--	--	--	Not classifiable as a human carcinogen	--	--
Manganese (non-diet)	--	--	--	--	Not classifiable as a human carcinogen	--	--
Mercury	--	--	--	--	Not classifiable as a human carcinogen	--	--
Methyl mercury	--	--	--	--	--	--	--
Nickel	--	--	--	--	--	--	--
Selenium	--	--	--	--	Not classifiable as a human carcinogen	--	--
Silver	--	--	--	--	Not classifiable as a human carcinogen	--	--
Thallium	--	--	--	--	--	--	--
Vanadium	--	--	--	--	--	--	--
Zinc	--	--	--	--	Not classifiable as a human carcinogen	--	--
PCBs							
Aroclor-1232 (PCB-1232)	2.00E+00	100%	2.00E+00	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Aroclor-1242 (PCB-1242)	2.00E+00	100%	2.00E+00	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Aroclor-1248 (PCB-1248)	2.00E+00	100%	2.00E+00	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Aroclor-1254 (PCB-1254)	2.00E+00	100%	2.00E+00	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Aroclor-1260 (PCB-1260)	2.00E+00	100%	2.00E+00	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Pesticides							
Chlordane	3.50E-01	100%	3.50E-01	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Feb-98
Dieldrin	1.60E+01	100%	1.60E+01	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jul-93
Heptachlor epoxide	9.10E+00	100%	9.10E+00	$(mg/kg\text{-}day)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jul-93
Dioxin/Furan							
Total TEQ	1.30E+05	100%	1.30E+05	$(mg/kg\text{-}day)^{-1}$	--	CalEPA	May-19

Table 6.1

Cancer Toxicity Data - Oral/Dermal Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Oral Cancer Slope Factor	Oral to Dermal Adjustment Factor (1)	Adjusted Dermal Cancer Slope Factor (2)	Units	Weight of Evidence/ Cancer Guideline Description	Source of CSF	Date of CSF (3) (MM-YY)
Asbestos							
Chrysotile asbestos	--	--	--	--	--	--	--

Notes:

-- = Not Available

(1) USEPA, Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual, Part E Supplemental Guidance for Dermal Risk Assessment, EPA/540/R/99/005, July 2004.
USEPA, Technical Guidance Manual Risk Assessment, Assessing Dermal Exposure from Soil, EPA/903-k-95-003, December 1995.

(2) Adjusted Dermal CSF = Oral CSF / Oral to Dermal Adjustment Factor

(3) Integrated Risk Information System (IRIS) Database, accessed November 2019.
Note: dates of CSF provided is the last revision date of the IRIS toxicity data provided (http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList).
Note: for carcinogenic PAHs, benzo(a)pyrene relative potency factors were applied as follows:
benzo(a)anthracene = 0.1; benzo(b)fluoranthene = 0.1; benzo(k)fluoranthene = 0.01; chrysene = 0.001; dibenz(a,h)anthracene = 1; indeno(1,2,3-cd)pyrene = 0.1
CalEPA, 2019. Technical Support Document for Cancer Potency Factors, Appendix A: A Lookup Table Containing Unit Risk and Cancer Potency Values, last revised May 14, 2019.
OEHHA: California Office of Environmental Health Hazard Assessment database, accessed November 2019.
Note: dates of CSF provided is the last revision date of the CalEPA toxicity data provided (https://oehha.ca.gov/chemicals).
Provisional Peer Reviewed Toxicity Values (PPRTV) Database, accessed November 2019.
Note: dates of CSF provided is the last revision date of the PPRTV toxicity data provided (https://hhpprtv.ornl.gov/).

Table 6.2

Cancer Toxicity Data - Inhalation Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Unit Risk Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source of RFC	Date of RfC (1) (MM-YY)
VOCs					
1,1-Dichloroethane	1.60E-03	$(mg/m^3)^{-1}$	Possible human carcinogen	CalEPA	May-19
1,2,4-Trichlorobenzene	--	--	--	--	--
1,2-Dibromo-3-chloropropane (DBCP)	6.00E+00	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	PPRTV	Aug-06
1,2-Dichloroethane	2.60E-02	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Mar-87
1,4-Dichlorobenzene	1.10E-02	$(mg/m^3)^{-1}$	--	CalEPA	May-19
1,4-Dioxane	5.00E-03	$(mg/m^3)^{-1}$	Likely to be carcinogenic to humans	IRIS	Sep-13
Benzene	7.80E-03	$(mg/m^3)^{-1}$	Known human carcinogen	IRIS	Jan-00
Bromodichloromethane	3.70E-02	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	CalEPA	May-19
Carbon tetrachloride	6.00E-03	$(mg/m^3)^{-1}$	Likely to be carcinogenic to humans	IRIS	Mar-10
Chlorobenzene	--	--	--	--	--
Chloroform (Trichloromethane)	2.30E-02	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Oct-01
cis-1,2-Dichloroethene	--	--	--	--	--
Ethylbenzene	2.50E-03	$(mg/m^3)^{-1}$	Not classifiable as a human carcinogen	CalEPA	May-19
Methylene chloride	1.00E-05	$(mg/m^3)^{-1}$	Likely to be carcinogenic to humans	IRIS	Nov-11
Tetrachloroethene	2.60E-04	$(mg/m^3)^{-1}$	Likely to be carcinogenic to humans	IRIS	Feb-12
Toluene	--	--	--	--	--
Trichloroethene	4.10E-03	$(mg/m^3)^{-1}$	Known human carcinogen	IRIS	Sep-11
Vinyl chloride - lifetime	8.80E-03	$(mg/m^3)^{-1}$	Known human carcinogen	IRIS	Aug-00
Vinyl chloride - adulthood	4.40E-03	$(mg/m^3)^{-1}$	Known human carcinogen	IRIS	Aug-00
Xylenes (total)	--	--	--	--	--
SVOCs					
Acenaphthene	--	--	--	--	--
Acenaphthylene	--	--	Not classifiable as a human carcinogen	--	--
Anthracene	--	--	Not classifiable as a human carcinogen	--	--
Benzo(a)anthracene	6.00E-02	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Benzo(a)pyrene	6.00E-01	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Benzo(b)fluoranthene	6.00E-02	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17

Table 6.2

Cancer Toxicity Data - Inhalation Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Unit Risk Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source of RFC	Date of RfC (1) (MM-YY)
SVOCs (cont.'d)					
Benzo(g,h,i)perylene	--	--	Not classifiable as a human carcinogen	--	--
Benzo(k)fluoranthene	6.00E-03	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Biphenyl (1,1'-Biphenyl)	--	--	Probable human carcinogen - sufficient evidence in animals	--	--
bis(2-Ethylhexyl)phthalate (DEHP)	2.40E-03	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	OEHHA	Jan-11
Carbazole	--	--	--	--	--
Chrysene	6.00E-04	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Dibenz(a,h)anthracene	6.00E-01	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Dibenzofuran	--	--	--	--	--
Fluoranthene	--	--	Not classifiable as a human carcinogen	--	--
Fluorene	--	--	Not classifiable as a human carcinogen	--	--
Indeno(1,2,3-cd)pyrene	6.00E-02	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jan-17
Naphthalene	3.40E-02	$(mg/m^3)^{-1}$	--	CalEPA	May-19
Phenanthrene	--	--	Not classifiable as a human carcinogen	--	--
Pyrene	--	--	Not classifiable as a human carcinogen	--	--
Metals					
Aluminum	--	--	--	--	--
Antimony	--	--	--	--	--
Arsenic	4.30E+00	$(mg/m^3)^{-1}$	Known human carcinogen	IRIS	Apr-98
Barium	--	--	Not classifiable as a human carcinogen	--	--
Beryllium	2.40E+00	$(mg/m^3)^{-1}$	Known human carcinogen	IRIS	Apr-98
Cadmium	1.80E+00	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in humans	IRIS	Jun-92
Chromium	--	--	Not classifiable as a human carcinogen	--	--
Chromium VI	8.40E+01	$(mg/m^3)^{-1}$	Known human carcinogen	IRIS (2)	Sep-98
Cobalt	9.00E+00	$(mg/m^3)^{-1}$	--	PPRTV	Aug-08
Copper	--	--	--	--	--
Cyanide	--	--	Not classifiable as a human carcinogen	--	--

Table 6.2

Cancer Toxicity Data - Inhalation Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Unit Risk Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source of RFC	Date of RfC (1) (MM-YY)
Metals (cont.'d)					
Iron	--	--	--	--	--
Lead	--	--	Probable human carcinogen - sufficient evidence in animals	--	--
Manganese (diet)	--	--	Not classifiable as a human carcinogen	--	--
Manganese (non-diet)	--	--	Not classifiable as a human carcinogen	--	--
Mercury	--	--	Not classifiable as a human carcinogen	--	--
Methyl mercury	--	--	--	--	--
Nickel	2.60E-01	$(mg/m^3)^{-1}$	--	CalEPA	May-19
Selenium	--	--	Not classifiable as a human carcinogen	--	--
Silver	--	--	Not classifiable as a human carcinogen	--	--
Thallium	--	--	--	--	--
Vanadium	--	--	--	--	--
Zinc	--	--	Not classifiable as a human carcinogen	--	--
PCBs					
Aroclor-1232 (PCB-1232)	5.70E-01	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Aroclor-1242 (PCB-1242)	5.70E-01	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Aroclor-1248 (PCB-1248)	5.70E-01	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Aroclor-1254 (PCB-1254)	5.70E-01	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Aroclor-1260 (PCB-1260)	5.70E-01	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jun-97
Pesticides					
Chlordane	1.00E-01	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Feb-98
Dieldrin	4.60E+00	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jul-93
Heptachlor epoxide	2.60E+00	$(mg/m^3)^{-1}$	Probable human carcinogen - sufficient evidence in animals	IRIS	Jul-93
Dioxin/Furan					
Total TEQ	3.80E+04	$(mg/m^3)^{-1}$	--	CalEPA	May-19

Table 6.2

Cancer Toxicity Data - Inhalation Route of Exposure
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	Unit Risk Factor	Units	Weight of Evidence/ Cancer Guideline Description	Source of RFC	Date of RfC (1) (MM-YY)
Asbestos					
Chrysotile asbestos	--	--	--	--	--

Notes:

-- = Not Available

(1) Integrated Risk Information System (IRIS) Database, accessed November 2019.

Note: dates of URF provided is the last revision date of the IRIS toxicity data provided (http://cfpub.epa.gov/ncea/iris/index.cfm?fuseaction=iris.showSubstanceList).

For carcinogenic PAHs, benzo(a)pyrene relative potency factors were applied as follows: benzo(a)anthracene = 0.1; benzo(b)fluoranthene = 0.1; benzo(k)fluoranthene = 0.01; chrysene = 0.001; dibenz(a,h)anthracene = 1; indeno(1,2,3-cd)pyrene = 0.1

CalEPA, 2019. Technical Support Document for Cancer Potency Factors, Appendix A: A Lookup Table Containing Unit Risk and Cancer Potency Values, last revised May 14, 2019.

OEHHA: California Office of Environmental Health Hazard Assessment database, accessed November 2019.

Note: dates of URF provided is the last revision date of the CalEPA toxicity data provided (https://oehha.ca.gov/chemicals).

Provisional Peer Reviewed Toxicity Values (PPRTV) Database, accessed November 2019.

Note: dates of URF provided is the last revision date of the PPRTV toxicity data provided (https://hhpprtv.ornl.gov/).

(2) For Cr(VI), IRIS shows an air inhalation unit risk (IUR) of 1.2E-2 per ($\mu g/m^3$). While the exact ratio of Cr(VI) to Cr(III) in the data used to derive the IRIS IUR value is not known, it is likely that both Cr(VI) and Cr(III) were pres
The URF is calculated using the IRIS IUR and assuming that the Cr(VI) to Cr(III) ratio is 1:6, therefore the Cr(VI) specific value (assuming 100% Cr(VI)) is derived by multiplying the IRIS IUR by 7.

Appendix B
ProUCL Input and Output Tables

Table B.1.1

Summary of ProUCL Input Data for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11	12
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum
on-site (EU01)	SS-37	11/20/2018	0-2 ft BGS	3400	1	3100	1	3900	1	130	1	570	1	1900	1	7500
on-site (EU01)	SS-38	11/20/2018	0-2 ft BGS	210	1	190	1	280	1	22	0	30	1	130	1	5000
on-site (EU01)	SS-39	11/1/2017	0-2 ft BGS	550	1	485	1	730	1	75	1	66.5	1	240	1	8050
on-site (EU01)	SS-40	11/20/2018	0-2 ft BGS	2500	1	2400	1	3400	1	330	1	530	1	1700	1	4000
on-site (EU01)	SS-41	11/20/2018	0-2 ft BGS													
on-site (EU01)	SS-42	11/27/2018	0-0.67 ft BGS	210	1	240	1	400	1	26	1	8	0	170	1	7500
on-site (EU01)	SS-43	11/27/2018	0.17-1 ft BGS	630	1	890	1	1200	1	84	1	160	1	560	1	5300
on-site (EU01)	SS-44	11/27/2018	0.08-1 ft BGS	320	1	450	1	630	1	84	0	30	0	220	1	3000
on-site (EU01)	SS-45	11/27/2018	0.17-1.5 ft BGS	600	1	580	1	920	1	130	1	98	1	330	1	4600
on-site (EU01)	SS-122	11/20/2018	0-2 ft BGS		1											
on-site (EU01)	SS-124	11/27/2018	0.17-1.5 ft BGS													
on-site (EU01)	SS-153-AS	11/20/2018	0-0.5 ft BGS													
on-site (EU01)	SS-154-AS	11/20/2018	0-0.5 ft BGS													
on-site (EU01)	SS-155-AS	11/27/2018	0.17-1.5 ft BGS													
on-site (EU01)	TT-16	9/30/2008	2 ft BGS													
on-site (EU01)	TT-16	9/30/2008	2- ft BGS	700	1	870	1	1100	1	90	1	150	1	540	1	5270

Table B.1.1

Summary of ProUCL Input Data for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	D_Aluminum	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU01)	SS-37	11/20/2018	0-2 ft BGS	1	7.8	1	1.5	0	6.8	1	37	1	16000	1	330	1	0.21	1	29	0
on-site (EU01)	SS-38	11/20/2018	0-2 ft BGS	1	5.6	1	0.27	0	4.5	1	17	1	13000	1	450	1	0.2	1	26	0
on-site (EU01)	SS-39	11/1/2017	0-2 ft BGS	1	25	1	2.2	1	8.8	1	42	1	12500	1	275	1	0.72	1	33	1
on-site (EU01)	SS-40	11/20/2018	0-2 ft BGS	1	5.4	1	0.31	1	3.9	1	19	1	9200	1	320	1	0.14	1	25	0
on-site (EU01)	SS-41	11/20/2018	0-2 ft BGS																	
on-site (EU01)	SS-42	11/27/2018	0-0.67 ft BGS	1	9.3	1	0.28	0	5.9	1	30	1	15000	1	530	1	0.2	1	180	1
on-site (EU01)	SS-43	11/27/2018	0.17-1 ft BGS	1	6.7	1	0.56	1	4.6	1	14	1	12000	1	300	1	0.15	1	27	0
on-site (EU01)	SS-44	11/27/2018	0.08-1 ft BGS	1	3.6	1	0.27	0	2.7	1	16	1	7000	1	320	1	0.12	1	25	0
on-site (EU01)	SS-45	11/27/2018	0.17-1.5 ft BGS	1	8.6	1	0.28	0	4.7	1	17	1	11000	1	390	1	0.19	1	26	0
on-site (EU01)	SS-122	11/20/2018	0-2 ft BGS																	
on-site (EU01)	SS-124	11/27/2018	0.17-1.5 ft BGS																	
on-site (EU01)	SS-153-AS	11/20/2018	0-0.5 ft BGS																	
on-site (EU01)	SS-154-AS	11/20/2018	0-0.5 ft BGS																	
on-site (EU01)	SS-155-AS	11/27/2018	0.17-1.5 ft BGS																	
on-site (EU01)	TT-16	9/30/2008	2 ft BGS														0.14	0	40	0
on-site (EU01)	TT-16	9/30/2008	2- ft BGS	1	5.5	1	1.1	1	4.8	1	12.6	1	11200	1	624	1				

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	7
Minimum	210	Mean	1013
Maximum	3400	Median	600
SD	1135	Std. Error of Mean	378.4
Coefficient of Variation	1.12	Skewness	1.676

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.709	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.387	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1717	95% Adjusted-CLT UCL (Chen-1995)	1862
		95% Modified-t UCL (Johnson-1978)	1752

Gamma GOF Test

A-D Test Statistic	0.725	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.306	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.286	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.22	k star (bias corrected MLE)	0.887
Theta hat (MLE)	830.9	Theta star (bias corrected MLE)	1142
nu hat (MLE)	21.95	nu star (bias corrected)	15.97
MLE Mean (bias corrected)	1013	MLE Sd (bias corrected)	1076
		Approximate Chi Square Value (0.05)	7.939
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	6.781

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2038	95% Adjusted Gamma UCL (use when n<50)	2386

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.347	Mean of logged Data	6.458
Maximum of Logged Data	8.132	SD of logged Data	0.978

Assuming Lognormal Distribution

95% H-UCL	3097	90% Chebyshev (MVUE) UCL	1930
95% Chebyshev (MVUE) UCL	2370	97.5% Chebyshev (MVUE) UCL	2980
99% Chebyshev (MVUE) UCL	4179		

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1636	95% Jackknife UCL	1717
95% Standard Bootstrap UCL	1587	95% Bootstrap-t UCL	4275
95% Hall's Bootstrap UCL	6412	95% Percentile Bootstrap UCL	1684
95% BCA Bootstrap UCL	1829		
90% Chebyshev(Mean, Sd) UCL	2148	95% Chebyshev(Mean, Sd) UCL	2663
97.5% Chebyshev(Mean, Sd) UCL	3376	99% Chebyshev(Mean, Sd) UCL	4778

Suggested UCL to Use

95% Adjusted Gamma UCL	2386

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	7
Minimum	190	Mean	1023
Maximum	3100	Median	580
SD	1023	Std. Error of Mean	341
Coefficient of Variation	1	Skewness	1.513

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.769	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.329	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1657	95% Adjusted-CLT UCL (Chen-1995)	1767
		95% Modified-t UCL (Johnson-1978)	1686

Gamma GOF Test

A-D Test Statistic	0.459	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.227	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.285	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.391	k star (bias corrected MLE)	1.001
Theta hat (MLE)	735.3	Theta star (bias corrected MLE)	1021
nu hat (MLE)	25.04	nu star (bias corrected)	18.02
MLE Mean (bias corrected)	1023	MLE Sd (bias corrected)	1022
		Approximate Chi Square Value (0.05)	9.408
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	8.129

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1959	95% Adjusted Gamma UCL (use when n<50)	2268

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.247	Mean of logged Data	6.53
Maximum of Logged Data	8.039	SD of logged Data	0.938

Assuming Lognormal Distribution

95% H-UCL	2980	90% Chebyshev (MVUE) UCL	1969
95% Chebyshev (MVUE) UCL	2408	97.5% Chebyshev (MVUE) UCL	3017
99% Chebyshev (MVUE) UCL	4215		

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1584	95% Jackknife UCL	1657
95% Standard Bootstrap UCL	1543	95% Bootstrap-t UCL	2849
95% Hall's Bootstrap UCL	5355	95% Percentile Bootstrap UCL	1554
95% BCA Bootstrap UCL	1673		
90% Chebyshev(Mean, Sd) UCL	2046	95% Chebyshev(Mean, Sd) UCL	2509
97.5% Chebyshev(Mean, Sd) UCL	3152	99% Chebyshev(Mean, Sd) UCL	4416

Suggested UCL to Use

95% Adjusted Gamma UCL	2268

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	7
Minimum	280	Mean	1396
Maximum	3900	Median	920
SD	1318	Std. Error of Mean	439.5
Coefficient of Variation	0.945	Skewness	1.438

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.761	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.337	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2213	95% Adjusted-CLT UCL (Chen-1995)	2343
		95% Modified-t UCL (Johnson-1978)	2248

Gamma GOF Test

A-D Test Statistic	0.5	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.242	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.284	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.558	k star (bias corrected MLE)	1.113
Theta hat (MLE)	895.8	Theta star (bias corrected MLE)	1254
nu hat (MLE)	28.04	nu star (bias corrected)	20.03
MLE Mean (bias corrected)	1396	MLE Sd (bias corrected)	1323
		Approximate Chi Square Value (0.05)	10.87
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	9.481

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2571	95% Adjusted Gamma UCL (use when n<50)	2948

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.186	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.635	Mean of logged Data	6.887
Maximum of Logged Data	8.269	SD of logged Data	0.878

Assuming Lognormal Distribution

95% H-UCL	3626	90% Chebyshev (MVUE) UCL	2601
95% Chebyshev (MVUE) UCL	3161	97.5% Chebyshev (MVUE) UCL	3939
99% Chebyshev (MVUE) UCL	5466		

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2118	95% Jackknife UCL	2213
95% Standard Bootstrap UCL	2066	95% Bootstrap-t UCL	3984
95% Hall's Bootstrap UCL	7477	95% Percentile Bootstrap UCL	2112
95% BCA Bootstrap UCL	2192		
90% Chebyshev(Mean, Sd) UCL	2714	95% Chebyshev(Mean, Sd) UCL	3311
97.5% Chebyshev(Mean, Sd) UCL	4140	99% Chebyshev(Mean, Sd) UCL	5768

Suggested UCL to Use

95% Adjusted Gamma UCL	2948

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
		Number of Missing Observations	7
Number of Detects	7	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	26	Minimum Non-Detect	22
Maximum Detect	330	Maximum Non-Detect	84
Variance Detects	9545	Percent Non-Detects	22.22%
Mean Detects	123.6	SD Detects	97.7
Median Detects	90	CV Detects	0.791
Skewness Detects	1.915	Kurtosis Detects	4.414
Mean of Logged Detects	4.577	SD of Logged Detects	0.763

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.789	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.331	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	103.1	KM Standard Error of Mean	32.2
KM SD	88.95	95% KM (BCA) UCL	157.4
95% KM (t) UCL	163	95% KM (Percentile Bootstrap) UCL	158.1
95% KM (z) UCL	156.1	95% KM Bootstrap t UCL	201.1
90% KM Chebyshev UCL	199.7	95% KM Chebyshev UCL	243.5
97.5% KM Chebyshev UCL	304.2	99% KM Chebyshev UCL	423.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.39	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.239	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.315	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.239	k star (bias corrected MLE)	1.375
Theta hat (MLE)	55.19	Theta star (bias corrected MLE)	89.89
nu hat (MLE)	31.35	nu star (bias corrected)	19.25
Mean (detects)	123.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	97.13
Maximum	330	Median	84
SD	99.58	CV	1.025
k hat (MLE)	0.496	k star (bias corrected MLE)	0.405
Theta hat (MLE)	195.7	Theta star (bias corrected MLE)	239.9
nu hat (MLE)	8.932	nu star (bias corrected)	7.288
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (7.29, α)	2.33	Adjusted Chi Square Value (7.29, β)	1.784
95% Gamma Approximate UCL (use when n>=50)	303.8	95% Gamma Adjusted UCL (use when n<50)	396.8

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	103.1	SD (KM)	88.95
Variance (KM)	7913	SE of Mean (KM)	32.2
k hat (KM)	1.344	k star (KM)	0.97
nu hat (KM)	24.19	nu star (KM)	17.46
theta hat (KM)	76.74	theta star (KM)	106.3
80% gamma percentile (KM)	166.4	90% gamma percentile (KM)	239.2
95% gamma percentile (KM)	312.3	99% gamma percentile (KM)	482.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.46, α)	9	Adjusted Chi Square Value (17.46, β)	7.753
95% Gamma Approximate KM-UCL (use when n>=50)	200	95% Gamma Adjusted KM-UCL (use when n<50)	232.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	101.6	Mean in Log Scale	4.26
SD in Original Scale	95.26	SD in Log Scale	0.929
95% t UCL (assumes normality of ROS data)	160.7	95% Percentile Bootstrap UCL	156.2
95% BCA Bootstrap UCL	175.2	95% Bootstrap t UCL	207.8
95% H-UCL (Log ROS)	299.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.299	KM Geo Mean	73.59
KM SD (logged)	0.84	95% Critical H Value (KM-Log)	2.894
KM Standard Error of Mean (logged)	0.312	95% H-UCL (KM -Log)	247.2
KM SD (logged)	0.84	95% Critical H Value (KM-Log)	2.894
KM Standard Error of Mean (logged)	0.312		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	102	Mean in Log Scale	4.242
SD in Original Scale	95.14	SD in Log Scale	0.996
95% t UCL (Assumes normality)	161	95% H-Stat UCL	356.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	232.2	95% GROS Adjusted Gamma UCL	396.8

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	7
Number of Detects	7	Number of Non-Detects	2
Number of Distinct Detects	7	Number of Distinct Non-Detects	2
Minimum Detect	30	Minimum Non-Detect	8
Maximum Detect	570	Maximum Non-Detect	30
Variance Detects	50175	Percent Non-Detects	22.22%
Mean Detects	229.2	SD Detects	224
Median Detects	150	CV Detects	0.977
Skewness Detects	1.069	Kurtosis Detects	-0.894
Mean of Logged Detects	4.984	SD of Logged Detects	1.065

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.784	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	180.1	KM Standard Error of Mean	73.71
KM SD	204.7	95% KM (BCA) UCL	310.9
95% KM (t) UCL	317.1	95% KM (Percentile Bootstrap) UCL	297.2
95% KM (z) UCL	301.3	95% KM Bootstrap t UCL	568.5
90% KM Chebyshev UCL	401.2	95% KM Chebyshev UCL	501.3
97.5% KM Chebyshev UCL	640.3	99% KM Chebyshev UCL	913.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.401	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.242	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.318	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.25	k star (bias corrected MLE)	0.809
Theta hat (MLE)	183.4	Theta star (bias corrected MLE)	283.2
nu hat (MLE)	17.5	nu star (bias corrected)	11.33
Mean (detects)	229.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	178.3
Maximum	570	Median	98
SD	218.7	CV	1.227
k hat (MLE)	0.296	k star (bias corrected MLE)	0.272
Theta hat (MLE)	601.3	Theta star (bias corrected MLE)	656.1
nu hat (MLE)	5.337	nu star (bias corrected)	4.891
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (4.89, α)	1.102	Adjusted Chi Square Value (4.89, β)	0.774
95% Gamma Approximate UCL (use when n>=50)	791.1	95% Gamma Adjusted UCL (use when n<50)	1127

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	180.1	SD (KM)	204.7
Variance (KM)	41908	SE of Mean (KM)	73.71
k hat (KM)	0.774	k star (KM)	0.59
nu hat (KM)	13.92	nu star (KM)	10.62
theta hat (KM)	232.8	theta star (KM)	305.3
80% gamma percentile (KM)	296.8	90% gamma percentile (KM)	470.1
95% gamma percentile (KM)	651.9	99% gamma percentile (KM)	1092

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.62, α)	4.331	Adjusted Chi Square Value (10.62, β)	3.524
95% Gamma Approximate KM-UCL (use when n>=50)	441.4	95% Gamma Adjusted KM-UCL (use when n<50)	542.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	180.7	Mean in Log Scale	4.405
SD in Original Scale	216.6	SD in Log Scale	1.473
95% t UCL (assumes normality of ROS data)	314.9	95% Percentile Bootstrap UCL	306.7
95% BCA Bootstrap UCL	326.1	95% Bootstrap t UCL	562.2
95% H-UCL (Log ROS)	2366		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.339	KM Geo Mean	76.59
KM SD (logged)	1.488	95% Critical H Value (KM-Log)	4.412
KM Standard Error of Mean (logged)	0.536	95% H-UCL (KM -Log)	2362
KM SD (logged)	1.488	95% Critical H Value (KM-Log)	4.412
KM Standard Error of Mean (logged)	0.536		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	180.4	Mean in Log Scale	4.331
SD in Original Scale	216.9	SD in Log Scale	1.624
95% t UCL (Assumes normality)	314.8	95% H-Stat UCL	4350

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	568.5	95% Gamma Adjusted KM-UCL (use when n<50)	542.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	7
Minimum	130	Mean	643.3
Maximum	1900	Median	330
SD	674.6	Std. Error of Mean	224.9
Coefficient of Variation	1.049	Skewness	1.439

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.733	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.327	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1062	95% Adjusted-CLT UCL (Chen-1995)	1128
		95% Modified-t UCL (Johnson-1978)	1079

Gamma GOF Test

A-D Test Statistic	0.622	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.738	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.285	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.29	k star (bias corrected MLE)	0.934
Theta hat (MLE)	498.6	Theta star (bias corrected MLE)	688.5
nu hat (MLE)	23.23	nu star (bias corrected)	16.82
MLE Mean (bias corrected)	643.3	MLE Sd (bias corrected)	665.6
		Approximate Chi Square Value (0.05)	8.542
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	7.333

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1267	95% Adjusted Gamma UCL (use when n<50)	1475

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.868	Mean of logged Data	6.032
Maximum of Logged Data	7.55	SD of logged Data	0.959

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	1919	90% Chebyshev (MVUE) UCL	1230
95% Chebyshev (MVUE) UCL	1507	97.5% Chebyshev (MVUE) UCL	1892
99% Chebyshev (MVUE) UCL	2649		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1013	95% Jackknife UCL	1062
95% Standard Bootstrap UCL	988	95% Bootstrap-t UCL	2069
95% Hall's Bootstrap UCL	3405	95% Percentile Bootstrap UCL	1012
95% BCA Bootstrap UCL	1137		
90% Chebyshev(Mean, Sd) UCL	1318	95% Chebyshev(Mean, Sd) UCL	1624
97.5% Chebyshev(Mean, Sd) UCL	2048	99% Chebyshev(Mean, Sd) UCL	2881

Suggested UCL to Use

95% Adjusted Gamma UCL 1475

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	7
Minimum	3000	Mean	5580
Maximum	8050	Median	5270
SD	1736	Std. Error of Mean	578.5
Coefficient of Variation	0.311	Skewness	0.213

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6656	95% Adjusted-CLT UCL (Chen-1995)	6575
		95% Modified-t UCL (Johnson-1978)	6663

Gamma GOF Test

A-D Test Statistic	0.359	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.206	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	11.22	k star (bias corrected MLE)	7.553
Theta hat (MLE)	497.4	Theta star (bias corrected MLE)	738.8
nu hat (MLE)	201.9	nu star (bias corrected)	136
MLE Mean (bias corrected)	5580	MLE Sd (bias corrected)	2030
		Approximate Chi Square Value (0.05)	110
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	105.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6896	95% Adjusted Gamma UCL (use when n<50)	7218

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.006	Mean of logged Data	8.582
Maximum of Logged Data	8.993	SD of logged Data	0.324

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	7103	90% Chebyshev (MVUE) UCL	7412
95% Chebyshev (MVUE) UCL	8238	97.5% Chebyshev (MVUE) UCL	9386
99% Chebyshev (MVUE) UCL	11639		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6532	95% Jackknife UCL	6656
95% Standard Bootstrap UCL	6472	95% Bootstrap-t UCL	6722
95% Hall's Bootstrap UCL	6469	95% Percentile Bootstrap UCL	6456
95% BCA Bootstrap UCL	6496		
90% Chebyshev(Mean, Sd) UCL	7316	95% Chebyshev(Mean, Sd) UCL	8102
97.5% Chebyshev(Mean, Sd) UCL	9193	99% Chebyshev(Mean, Sd) UCL	11336

Suggested UCL to Use

95% Student's-t UCL	6656

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	7
Minimum	3.6	Mean	8.611
Maximum	25	Median	6.7
SD	6.399	Std. Error of Mean	2.133
Coefficient of Variation	0.743	Skewness	2.563

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.658	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.346	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	12.58	95% Adjusted-CLT UCL (Chen-1995)	14.07
		95% Modified-t UCL (Johnson-1978)	12.88

Gamma GOF Test

A-D Test Statistic	0.775	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.726	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.261	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.281	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.314	k star (bias corrected MLE)	2.283
Theta hat (MLE)	2.599	Theta star (bias corrected MLE)	3.772
nu hat (MLE)	59.64	nu star (bias corrected)	41.1
MLE Mean (bias corrected)	8.611	MLE Sd (bias corrected)	5.699
		Approximate Chi Square Value (0.05)	27.4
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	25.07

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	12.91	95% Adjusted Gamma UCL (use when n<50)	14.12

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.281	Mean of logged Data	1.995
Maximum of Logged Data	3.219	SD of logged Data	0.542

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	13.24	90% Chebyshev (MVUE) UCL	12.97
95% Chebyshev (MVUE) UCL	15.06	97.5% Chebyshev (MVUE) UCL	17.96
99% Chebyshev (MVUE) UCL	23.65		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	12.12	95% Jackknife UCL	12.58
95% Standard Bootstrap UCL	11.94	95% Bootstrap-t UCL	19.23
95% Hall's Bootstrap UCL	26.47	95% Percentile Bootstrap UCL	12.36
95% BCA Bootstrap UCL	13.96		
90% Chebyshev(Mean, Sd) UCL	15.01	95% Chebyshev(Mean, Sd) UCL	17.91
97.5% Chebyshev(Mean, Sd) UCL	21.93	99% Chebyshev(Mean, Sd) UCL	29.83

Suggested UCL to Use

95% Adjusted Gamma UCL	14.12

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
		Number of Missing Observations	7
Number of Detects	4	Number of Non-Detects	5
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	0.31	Minimum Non-Detect	0.27
Maximum Detect	2.2	Maximum Non-Detect	1.5
Variance Detects	0.704	Percent Non-Detects	55.56%
Mean Detects	1.043	SD Detects	0.839
Median Detects	0.83	CV Detects	0.805
Skewness Detects	1.18	Kurtosis Detects	0.867
Mean of Logged Detects	-0.217	SD of Logged Detects	0.847

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.223	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.632	KM Standard Error of Mean	0.241
KM SD	0.618	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.08	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.028	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.355	95% KM Chebyshev UCL	1.682
97.5% KM Chebyshev UCL	2.137	99% KM Chebyshev UCL	3.029

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.226	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.66	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.216	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.398	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.086	k star (bias corrected MLE)	0.688
Theta hat (MLE)	0.5	Theta star (bias corrected MLE)	1.515
nu hat (MLE)	16.69	nu star (bias corrected)	5.506
Mean (detects)	1.043		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.469
Maximum	2.2	Median	0.01
SD	0.748	CV	1.596
k hat (MLE)	0.354	k star (bias corrected MLE)	0.31
Theta hat (MLE)	1.325	Theta star (bias corrected MLE)	1.513
nu hat (MLE)	6.368	nu star (bias corrected)	5.579
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (5.58, α)	1.428	Adjusted Chi Square Value (5.58, β)	1.034
95% Gamma Approximate UCL (use when n>=50)	1.831	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.632	SD (KM)	0.618
Variance (KM)	0.381	SE of Mean (KM)	0.241
k hat (KM)	1.046	k star (KM)	0.772
nu hat (KM)	18.84	nu star (KM)	13.89
theta hat (KM)	0.604	theta star (KM)	0.819
80% gamma percentile (KM)	1.034	90% gamma percentile (KM)	1.549
95% gamma percentile (KM)	2.076	99% gamma percentile (KM)	3.323

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.89, α)	6.497	Adjusted Chi Square Value (13.89, β)	5.467
95% Gamma Approximate KM-UCL (use when n>=50)	1.351	95% Gamma Adjusted KM-UCL (use when n<50)	1.605

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.991	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.533	Mean in Log Scale	-1.303
SD in Original Scale	0.707	SD in Log Scale	1.211
95% t UCL (assumes normality of ROS data)	0.971	95% Percentile Bootstrap UCL	0.948
95% BCA Bootstrap UCL	1.098	95% Bootstrap t UCL	1.939
95% H-UCL (Log ROS)	2.785		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.788	KM Geo Mean	0.455
KM SD (logged)	0.733	95% Critical H Value (KM-Log)	2.681
KM Standard Error of Mean (logged)	0.291	95% H-UCL (KM -Log)	1.192
KM SD (logged)	0.733	95% Critical H Value (KM-Log)	2.681
KM Standard Error of Mean (logged)	0.291		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.608	Mean in Log Scale	-1.01
SD in Original Scale	0.687	SD in Log Scale	1.06
95% t UCL (Assumes normality)	1.033	95% H-Stat UCL	2.261

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.08

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	7
Minimum	2.7	Mean	5.189
Maximum	8.8	Median	4.7
SD	1.775	Std. Error of Mean	0.592
Coefficient of Variation	0.342	Skewness	0.959

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.253	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.289	95% Adjusted-CLT UCL (Chen-1995)	6.364
		95% Modified-t UCL (Johnson-1978)	6.321

Gamma GOF Test

A-D Test Statistic	0.314	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.222	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.13	k star (bias corrected MLE)	6.828
Theta hat (MLE)	0.512	Theta star (bias corrected MLE)	0.76
nu hat (MLE)	182.3	nu star (bias corrected)	122.9
MLE Mean (bias corrected)	5.189	MLE Sd (bias corrected)	1.986
		Approximate Chi Square Value (0.05)	98.3
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	93.66

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.488	95% Adjusted Gamma UCL (use when n<50)	6.809

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.993	Mean of logged Data	1.596
Maximum of Logged Data	2.175	SD of logged Data	0.336

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	6.666	90% Chebyshev (MVUE) UCL	6.945
95% Chebyshev (MVUE) UCL	7.741	97.5% Chebyshev (MVUE) UCL	8.846
99% Chebyshev (MVUE) UCL	11.02		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.162	95% Jackknife UCL	6.289
95% Standard Bootstrap UCL	6.097	95% Bootstrap-t UCL	6.734
95% Hall's Bootstrap UCL	8.965	95% Percentile Bootstrap UCL	6.1
95% BCA Bootstrap UCL	6.311		
90% Chebyshev(Mean, Sd) UCL	6.964	95% Chebyshev(Mean, Sd) UCL	7.768
97.5% Chebyshev(Mean, Sd) UCL	8.884	99% Chebyshev(Mean, Sd) UCL	11.08

Suggested UCL to Use

95% Student's-t UCL	6.289

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	7
Minimum	7000	Mean	11878
Maximum	16000	Median	12000
SD	2752	Std. Error of Mean	917.4
Coefficient of Variation	0.232	Skewness	-0.263

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.153	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	13584	95% Adjusted-CLT UCL (Chen-1995)	13301
		95% Modified-t UCL (Johnson-1978)	13570

Gamma GOF Test

A-D Test Statistic	0.232	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.177	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	19.16	k star (bias corrected MLE)	12.85
Theta hat (MLE)	619.8	Theta star (bias corrected MLE)	924.4
nu hat (MLE)	344.9	nu star (bias corrected)	231.3
MLE Mean (bias corrected)	11878	MLE Sd (bias corrected)	3314
		Approximate Chi Square Value (0.05)	197.1
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	190.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	13939	95% Adjusted Gamma UCL (use when n<50)	14427

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.854	Mean of logged Data	9.356
Maximum of Logged Data	9.68	SD of logged Data	0.251

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	14199	90% Chebyshev (MVUE) UCL	14887
95% Chebyshev (MVUE) UCL	16243	97.5% Chebyshev (MVUE) UCL	18124
99% Chebyshev (MVUE) UCL	21819		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13387	95% Jackknife UCL	13584
95% Standard Bootstrap UCL	13317	95% Bootstrap-t UCL	13479
95% Hall's Bootstrap UCL	13544	95% Percentile Bootstrap UCL	13300
95% BCA Bootstrap UCL	13300		
90% Chebyshev(Mean, Sd) UCL	14630	95% Chebyshev(Mean, Sd) UCL	15877
97.5% Chebyshev(Mean, Sd) UCL	17607	99% Chebyshev(Mean, Sd) UCL	21006

Suggested UCL to Use

95% Student's-t UCL	13584

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	9	Number of Distinct Observations	8
		Number of Missing Observations	7
Minimum	275	Mean	393.2
Maximum	624	Median	330
SD	118.6	Std. Error of Mean	39.54
Coefficient of Variation	0.302	Skewness	1.11

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.259	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	466.8	95% Adjusted-CLT UCL (Chen-1995)	473.9
		95% Modified-t UCL (Johnson-1978)	469.2

Gamma GOF Test

A-D Test Statistic	0.503	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.262	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.86	k star (bias corrected MLE)	9.312
Theta hat (MLE)	28.38	Theta star (bias corrected MLE)	42.23
nu hat (MLE)	249.4	nu star (bias corrected)	167.6
MLE Mean (bias corrected)	393.2	MLE Sd (bias corrected)	128.9
		Approximate Chi Square Value (0.05)	138.7
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	133.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	475.3	95% Adjusted Gamma UCL (use when n<50)	495.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.617	Mean of logged Data	5.938
Maximum of Logged Data	6.436	SD of logged Data	0.28

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	479.9	90% Chebyshev (MVUE) UCL	502.8
95% Chebyshev (MVUE) UCL	552.7	97.5% Chebyshev (MVUE) UCL	622
99% Chebyshev (MVUE) UCL	758.2		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	458.3	95% Jackknife UCL	466.8
95% Standard Bootstrap UCL	453.6	95% Bootstrap-t UCL	517.5
95% Hall's Bootstrap UCL	489.9	95% Percentile Bootstrap UCL	460.4
95% BCA Bootstrap UCL	468		
90% Chebyshev(Mean, Sd) UCL	511.9	95% Chebyshev(Mean, Sd) UCL	565.6
97.5% Chebyshev(Mean, Sd) UCL	640.2	99% Chebyshev(Mean, Sd) UCL	786.7

Suggested UCL to Use

95% Student's-t UCL	466.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
		Number of Missing Observations	6
Number of Detects	8	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.12	Minimum Non-Detect	0.14
Maximum Detect	0.72	Maximum Non-Detect	0.14
Variance Detects	0.0385	Percent Non-Detects	11.11%
Mean Detects	0.241	SD Detects	0.196
Median Detects	0.195	CV Detects	0.813
Skewness Detects	2.669	Kurtosis Detects	7.346
Mean of Logged Detects	-1.594	SD of Logged Detects	0.55

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.578	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.438	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.228	KM Standard Error of Mean	0.0631
KM SD	0.177	95% KM (BCA) UCL	0.353
95% KM (t) UCL	0.345	95% KM (Percentile Bootstrap) UCL	0.348
95% KM (z) UCL	0.332	95% KM Bootstrap t UCL	0.633
90% KM Chebyshev UCL	0.417	95% KM Chebyshev UCL	0.503
97.5% KM Chebyshev UCL	0.622	99% KM Chebyshev UCL	0.856

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.172	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.721	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.392	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.296	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.062	k star (bias corrected MLE)	1.997
Theta hat (MLE)	0.0788	Theta star (bias corrected MLE)	0.121
nu hat (MLE)	48.99	nu star (bias corrected)	31.95
Mean (detects)	0.241		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0185	Mean	0.217
Maximum	0.72	Median	0.19
SD	0.198	CV	0.914
k hat (MLE)	1.662	k star (bias corrected MLE)	1.182
Theta hat (MLE)	0.13	Theta star (bias corrected MLE)	0.183
nu hat (MLE)	29.92	nu star (bias corrected)	21.28
Adjusted Level of Significance (β)	0.0231		
Approximate Chi Square Value (21.28, α)	11.8	Adjusted Chi Square Value (21.28, β)	10.34
95% Gamma Approximate UCL (use when n>=50)	0.39	95% Gamma Adjusted UCL (use when n<50)	0.445

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.228	SD (KM)	0.177
Variance (KM)	0.0314	SE of Mean (KM)	0.0631
k hat (KM)	1.653	k star (KM)	1.176
nu hat (KM)	29.75	nu star (KM)	21.16
theta hat (KM)	0.138	theta star (KM)	0.194
80% gamma percentile (KM)	0.361	90% gamma percentile (KM)	0.504
95% gamma percentile (KM)	0.645	99% gamma percentile (KM)	0.968

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (21.16, α)	11.71	Adjusted Chi Square Value (21.16, β)	10.26
95% Gamma Approximate KM-UCL (use when n>=50)	0.412	95% Gamma Adjusted KM-UCL (use when n<50)	0.47

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.757	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.351	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.225	Mean in Log Scale	-1.681
SD in Original Scale	0.19	SD in Log Scale	0.577
95% t UCL (assumes normality of ROS data)	0.343	95% Percentile Bootstrap UCL	0.345
95% BCA Bootstrap UCL	0.369	95% Bootstrap t UCL	0.6
95% H-UCL (Log ROS)	0.357		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.653	KM Geo Mean	0.192
KM SD (logged)	0.512	95% Critical H Value (KM-Log)	2.246
KM Standard Error of Mean (logged)	0.183	95% H-UCL (KM -Log)	0.328
KM SD (logged)	0.512	95% Critical H Value (KM-Log)	2.246
KM Standard Error of Mean (logged)	0.183		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.222	Mean in Log Scale	-1.712
SD in Original Scale	0.192	SD in Log Scale	0.625
95% t UCL (Assumes normality)	0.341	95% H-Stat UCL	0.38

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	0.503

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	7
		Number of Missing Observations	6
Number of Detects	2	Number of Non-Detects	7
Number of Distinct Detects	2	Number of Distinct Non-Detects	5
Minimum Detect	33	Minimum Non-Detect	25
Maximum Detect	180	Maximum Non-Detect	40
Variance Detects	10805	Percent Non-Detects	77.78%
Mean Detects	106.5	SD Detects	103.9
Median Detects	106.5	CV Detects	0.976
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	4.345	SD of Logged Detects	1.2

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	43.24	KM Standard Error of Mean	22.83
KM SD	48.42	95% KM (BCA) UCL	N/A
95% KM (t) UCL	85.7	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	80.79	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	111.7	95% KM Chebyshev UCL	142.8
97.5% KM Chebyshev UCL	185.8	99% KM Chebyshev UCL	270.4

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.694	k star (bias corrected MLE)	N/A
Theta hat (MLE)	62.89	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	6.774	nu star (bias corrected)	N/A
Mean (detects)	106.5		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	43.24	SD (KM)	48.42
Variance (KM)	2345	SE of Mean (KM)	22.83
k hat (KM)	0.797	k star (KM)	0.606
nu hat (KM)	14.35	nu star (KM)	10.9
theta hat (KM)	54.23	theta star (KM)	71.4
80% gamma percentile (KM)	71.27	90% gamma percentile (KM)	112.2
95% gamma percentile (KM)	155.1	99% gamma percentile (KM)	258.6

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0231
Approximate Chi Square Value (10.90, α)	4.512	Adjusted Chi Square Value (10.90, β)	3.685
95% Gamma Approximate KM-UCL (use when n>=50)	104.5	95% Gamma Adjusted KM-UCL (use when n<50)	127.9

Table B.1.2

Summary of ProUCL Output for EU01 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/17/2019 2:34:24 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	25	Mean in Log Scale	1.223
SD in Original Scale	59.05	SD in Log Scale	1.929
95% t UCL (assumes normality of ROS data)	61.6	95% Percentile Bootstrap UCL	61.11
95% BCA Bootstrap UCL	81.14	95% Bootstrap t UCL	1369
95% H-UCL (Log ROS)	946.7		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.473	KM Geo Mean	32.25
KM SD (logged)	0.615	95% Critical H Value (KM-Log)	2.468
KM Standard Error of Mean (logged)	0.29	95% H-UCL (KM -Log)	66.61
KM SD (logged)	0.615	95% Critical H Value (KM-Log)	2.468
KM Standard Error of Mean (logged)	0.29		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	34.67	Mean in Log Scale	3.016
SD in Original Scale	54.9	SD in Log Scale	0.876
95% t UCL (Assumes normality)	68.7	95% H-Stat UCL	75.24

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	142.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.2.1

Summary of ProUCL Input Data for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11	12	13
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aluminum	D_Aluminum	Arsenic	D_Arsenic	Cobalt	D_Cobalt	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium
on-site (EU02)	SS-14	11/20/2018	0-2 ft BGS	12000	1	10	1	8.2	1	22000	1	730	1	0.2	1	33	1
on-site (EU02)	SS-15	11/20/2018	0-2 ft BGS	17000	1	12	1	8.2	1	26000	1	670	1	0.26	1	43	1
on-site (EU02)	SS-16	11/20/2018	0-2 ft BGS	14000	1	8.3	1	7.5	1	20000	1	660	1	0.21	1	34	1
on-site (EU02)	SS-17	11/20/2018	0-2 ft BGS	14000	1	14	1	8.4	1	25000	1	580	1	0.24	1	35	1
on-site (EU02)	SS-18	11/20/2018	0-2 ft BGS	13000	1	10	1	7.9	1	22000	1	590	1	0.23	1	35	1
on-site (EU02)	SS-148	11/20/2018	0-2 ft BGS														
on-site (EU02)	SS-152	11/20/2018	0-2 ft BGS														
on-site (EU02)	SS-156-AS	11/20/2018	0-0.5 ft BGS														
on-site (EU02)	SS-157-AS	11/20/2018	0-0.5 ft BGS														

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	12000	Mean	14000
Maximum	17000	Median	14000
SD	1871	Std. Error of Mean	836.7
Coefficient of Variation	0.134	Skewness	1.145

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15784	95% Adjusted-CLT UCL (Chen-1995)	15834
		95% Modified-t UCL (Johnson-1978)	15855

Gamma GOF Test

A-D Test Statistic	0.344	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.284	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	73.47	k star (bias corrected MLE)	29.52
Theta hat (MLE)	190.5	Theta star (bias corrected MLE)	474.2
nu hat (MLE)	734.7	nu star (bias corrected)	295.2
MLE Mean (bias corrected)	14000	MLE Sd (bias corrected)	2577
		Approximate Chi Square Value (0.05)	256.4
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	240.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	16118	95% Adjusted Gamma UCL (use when n<50)	17188

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.393	Mean of logged Data	9.54
Maximum of Logged Data	9.741	SD of logged Data	0.129

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	16035	90% Chebyshev (MVUE) UCL	16422
95% Chebyshev (MVUE) UCL	17520	97.5% Chebyshev (MVUE) UCL	19044
99% Chebyshev (MVUE) UCL	22038		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	15376	95% Jackknife UCL	15784
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	16510	95% Chebyshev(Mean, Sd) UCL	17647
97.5% Chebyshev(Mean, Sd) UCL	19225	99% Chebyshev(Mean, Sd) UCL	22325

Suggested UCL to Use

95% Student's-t UCL	15784

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	8.3	Mean	10.86
Maximum	14	Median	10
SD	2.19	Std. Error of Mean	0.98
Coefficient of Variation	0.202	Skewness	0.571

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.253	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	12.95	95% Adjusted-CLT UCL (Chen-1995)	12.74
		95% Modified-t UCL (Johnson-1978)	12.99

Gamma GOF Test

A-D Test Statistic	0.271	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.254	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	31.4	k star (bias corrected MLE)	12.69
Theta hat (MLE)	0.346	Theta star (bias corrected MLE)	0.856
nu hat (MLE)	314	nu star (bias corrected)	126.9
MLE Mean (bias corrected)	10.86	MLE Sd (bias corrected)	3.048
		Approximate Chi Square Value (0.05)	101.9
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	92.11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	13.53	95% Adjusted Gamma UCL (use when n<50)	14.97

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.116	Mean of logged Data	2.369
Maximum of Logged Data	2.639	SD of logged Data	0.199

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	13.57	90% Chebyshev (MVUE) UCL	13.76
95% Chebyshev (MVUE) UCL	15.07	97.5% Chebyshev (MVUE) UCL	16.9
99% Chebyshev (MVUE) UCL	20.48		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	12.47	95% Jackknife UCL	12.95
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	13.8	95% Chebyshev(Mean, Sd) UCL	15.13
97.5% Chebyshev(Mean, Sd) UCL	16.98	99% Chebyshev(Mean, Sd) UCL	20.61

Suggested UCL to Use

95% Student's-t UCL	12.95

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	7.5	Mean	8.04
Maximum	8.4	Median	8.2
SD	0.351	Std. Error of Mean	0.157
Coefficient of Variation	0.0436	Skewness	-1.018

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8.374	95% Adjusted-CLT UCL (Chen-1995)	8.222
		95% Modified-t UCL (Johnson-1978)	8.362

Gamma GOF Test

A-D Test Statistic	0.373	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.297	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	644.6	k star (bias corrected MLE)	258
Theta hat (MLE)	0.0125	Theta star (bias corrected MLE)	0.0312
nu hat (MLE)	6446	nu star (bias corrected)	2580
MLE Mean (bias corrected)	8.04	MLE Sd (bias corrected)	0.501
		Approximate Chi Square Value (0.05)	2463
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	2412

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8.422	95% Adjusted Gamma UCL (use when n<50)	8.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.278	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.015	Mean of logged Data	2.084
Maximum of Logged Data	2.128	SD of logged Data	0.0443

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	8.517
95% Chebyshev (MVUE) UCL	8.734	97.5% Chebyshev (MVUE) UCL	9.034
99% Chebyshev (MVUE) UCL	9.623		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8.298	95% Jackknife UCL	8.374
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	8.511	95% Chebyshev(Mean, Sd) UCL	8.724
97.5% Chebyshev(Mean, Sd) UCL	9.019	99% Chebyshev(Mean, Sd) UCL	9.601

Suggested UCL to Use

95% Student's-t UCL	8.374

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	20000	Mean	23000
Maximum	26000	Median	22000
SD	2449	Std. Error of Mean	1095
Coefficient of Variation	0.106	Skewness	0.17

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	25335	95% Adjusted-CLT UCL (Chen-1995)	24891
		95% Modified-t UCL (Johnson-1978)	25349

Gamma GOF Test

A-D Test Statistic	0.347	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.267	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	110.4	k star (bias corrected MLE)	44.29
Theta hat (MLE)	208.4	Theta star (bias corrected MLE)	519.3
nu hat (MLE)	1104	nu star (bias corrected)	442.9
MLE Mean (bias corrected)	23000	MLE Sd (bias corrected)	3456
		Approximate Chi Square Value (0.05)	395.1
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	375.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	25782	95% Adjusted Gamma UCL (use when n<50)	27156

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.903	Mean of logged Data	10.04
Maximum of Logged Data	10.17	SD of logged Data	0.106

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	25674	90% Chebyshev (MVUE) UCL	26285
95% Chebyshev (MVUE) UCL	27773	97.5% Chebyshev (MVUE) UCL	29838
99% Chebyshev (MVUE) UCL	33895		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	24802	95% Jackknife UCL	25335
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	26286	95% Chebyshev(Mean, Sd) UCL	27775
97.5% Chebyshev(Mean, Sd) UCL	29841	99% Chebyshev(Mean, Sd) UCL	33900

Suggested UCL to Use

95% Student's-t UCL	25335

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	580	Mean	646
Maximum	730	Median	660
SD	61.89	Std. Error of Mean	27.68
Coefficient of Variation	0.0958	Skewness	0.257

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	705	95% Adjusted-CLT UCL (Chen-1995)	694.9
		95% Modified-t UCL (Johnson-1978)	705.5

Gamma GOF Test

A-D Test Statistic	0.332	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	136.9	k star (bias corrected MLE)	54.89
Theta hat (MLE)	4.719	Theta star (bias corrected MLE)	11.77
nu hat (MLE)	1369	nu star (bias corrected)	548.9
MLE Mean (bias corrected)	646	MLE Sd (bias corrected)	87.19
		Approximate Chi Square Value (0.05)	495.6
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	473.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	715.5	95% Adjusted Gamma UCL (use when n<50)	749.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.219	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.363	Mean of logged Data	6.467
Maximum of Logged Data	6.593	SD of logged Data	0.0955

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	N/A	90% Chebyshev (MVUE) UCL	728.8
95% Chebyshev (MVUE) UCL	766.3	97.5% Chebyshev (MVUE) UCL	818.3
99% Chebyshev (MVUE) UCL	920.5		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	691.5	95% Jackknife UCL	705
95% Standard Bootstrap UCL	686	95% Bootstrap-t UCL	717
95% Hall's Bootstrap UCL	683.1	95% Percentile Bootstrap UCL	688
95% BCA Bootstrap UCL	686		
90% Chebyshev(Mean, Sd) UCL	729	95% Chebyshev(Mean, Sd) UCL	766.6
97.5% Chebyshev(Mean, Sd) UCL	818.8	99% Chebyshev(Mean, Sd) UCL	921.4

Suggested UCL to Use

95% Student's-t UCL	705

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	0.2	Mean	0.228
Maximum	0.26	Median	0.23
SD	0.0239	Std. Error of Mean	0.0107
Coefficient of Variation	0.105	Skewness	0.206

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.251	95% Adjusted-CLT UCL (Chen-1995)	0.247
		95% Modified-t UCL (Johnson-1978)	0.251

Gamma GOF Test

A-D Test Statistic	0.209	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.198	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	114.3	k star (bias corrected MLE)	45.85
Theta hat (MLE)	0.00199	Theta star (bias corrected MLE)	0.00497
nu hat (MLE)	1143	nu star (bias corrected)	458.5
MLE Mean (bias corrected)	0.228	MLE Sd (bias corrected)	0.0337
		Approximate Chi Square Value (0.05)	409.9
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	389.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.255	95% Adjusted Gamma UCL (use when n<50)	0.268

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.609	Mean of logged Data	-1.483
Maximum of Logged Data	-1.347	SD of logged Data	0.105

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	0.254	90% Chebyshev (MVUE) UCL	0.26
95% Chebyshev (MVUE) UCL	0.274	97.5% Chebyshev (MVUE) UCL	0.295
99% Chebyshev (MVUE) UCL	0.334		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.246	95% Jackknife UCL	0.251
95% Standard Bootstrap UCL	0.244	95% Bootstrap-t UCL	0.251
95% Hall's Bootstrap UCL	0.246	95% Percentile Bootstrap UCL	0.244
95% BCA Bootstrap UCL	0.244		
90% Chebyshev(Mean, Sd) UCL	0.26	95% Chebyshev(Mean, Sd) UCL	0.275
97.5% Chebyshev(Mean, Sd) UCL	0.295	99% Chebyshev(Mean, Sd) UCL	0.334

Suggested UCL to Use

95% Student's-t UCL	0.251

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	0
Minimum	33	Mean	36
Maximum	43	Median	35
SD	4	Std. Error of Mean	1.789
Coefficient of Variation	0.111	Skewness	1.992

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.741	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.399	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	39.81	95% Adjusted-CLT UCL (Chen-1995)	40.65
		95% Modified-t UCL (Johnson-1978)	40.08

Gamma GOF Test

A-D Test Statistic	0.744	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.678	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.403	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.357	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	109.7	k star (bias corrected MLE)	44
Theta hat (MLE)	0.328	Theta star (bias corrected MLE)	0.818
nu hat (MLE)	1097	nu star (bias corrected)	440
MLE Mean (bias corrected)	36	MLE Sd (bias corrected)	5.427
		Approximate Chi Square Value (0.05)	392.4
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	372.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	40.37	95% Adjusted Gamma UCL (use when n<50)	42.53

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.762	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.389	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.497	Mean of logged Data	3.579
Maximum of Logged Data	3.761	SD of logged Data	0.105

Table B.2.2

Summary of ProUCL Output for EU02 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 11:55:55 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	40.1	90% Chebyshev (MVUE) UCL	41.05
95% Chebyshev (MVUE) UCL	43.34	97.5% Chebyshev (MVUE) UCL	46.52
99% Chebyshev (MVUE) UCL	52.76		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	38.94	95% Jackknife UCL	39.81
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	41.37	95% Chebyshev(Mean, Sd) UCL	43.8
97.5% Chebyshev(Mean, Sd) UCL	47.17	99% Chebyshev(Mean, Sd) UCL	53.8

Suggested UCL to Use

95% Student's-t UCL	39.81	or 95% Modified-t UCL	40.08
or 95% H-UCL	40.1		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.3.1

Summary of ProUCL Input Data for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Benzo(k)fluoranthene	D_Benzo(k)fluoranthene	Carbazole	D_Carbazole	Chrysene	D_Chrysene
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	260000	1	270000	1	330000	1	130000	1	92000	1	250000	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	440	1	680	1	960	1	510	1	200	0	580	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	1400	1	1500	1	2000	1	790	1	160	1	1400	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	63	1	59	1	70	1	30	1	21	0	57	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	49	1	43	1	67	1	27	1	22	0	61	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	800	1	730	1	870	1	340	1	81	0	830	1

Table B.3.1

Summary of ProUCL Input Data for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Dibenzofuran	D_Dibenzofuran	Fluoranthene	D_Fluoranthene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Naphthalene	D_Naphthalene	Phenanthrene	D_Phenanthrene
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	39000	1	30000	1	590000	1	120000	1	18000	1	480000	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	7	0	140	0	800	1	410	1	8.7	0	360	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	230	1	72	1	2700	1	770	1	110	1	940	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	0.74	0	15	0	100	1	30	1	0.92	0	48	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	9.3	1	15	0	110	1	31	1	8	1	80	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	100	1	56	0	1900	1	370	1	21	1	490	1

Table B.3.1

Summary of ProUCL Input Data for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				24	25	26	27	28	29	30	31	32	33	34	35	36	37
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Pyrene	D_Pyrene	Aluminum	D_Aluminum	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Iron	D_Iron	Lead	D_Lead
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	450000	1	5900	1	9.4	1	0.27	0	5.1	1	22000	1	1000	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	890	1	9800	1	1.8	1	0.66	1	1.2	1	54000	1	14	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	2300	1	5100	1	6	1	0.85	1	5.3	1	14000	1	26	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	93	1	6200	1	6.1	1	1.4	0	4.6	1	14000	1	49	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	90	1	7200	1	7	1	0.27	0	7.9	1	13000	1	23	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	1700	1	3500	1	5.7	1	0.26	0	3.4	1	10000	1	9.1	1

Table B.3.1

Summary of ProUCL Input Data for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				38	39	40	41	42	43
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	390	1	0.25	1	18	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	6000	1	0.046	0	170	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	580	1	0.19	1	22	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	390	1	0.12	1	16	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	690	1	0.2	1	21	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	370	1	0.11	1	12	1

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	49	Mean	43792
Maximum	260000	Median	620
SD	105921	Std. Error of Mean	43242
Coefficient of Variation	2.419	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.501	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.489	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	130927	95% Adjusted-CLT UCL (Chen-1995)	161121
		95% Modified-t UCL (Johnson-1978)	138134

Gamma GOF Test

A-D Test Statistic	0.966	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.812	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.42	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.365	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.189	k star (bias corrected MLE)	0.205
Theta hat (MLE)	232009	Theta star (bias corrected MLE)	213113
nu hat (MLE)	2.265	nu star (bias corrected)	2.466
MLE Mean (bias corrected)	43792	MLE Sd (bias corrected)	96606
		Approximate Chi Square Value (0.05)	0.234
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	462417	95% Adjusted Gamma UCL (use when n<50)	979558

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.271	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.892	Mean of logged Data	6.753
Maximum of Logged Data	12.47	SD of logged Data	3.11

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	1.464E+12	90% Chebyshev (MVUE) UCL	56668
95% Chebyshev (MVUE) UCL	75384	97.5% Chebyshev (MVUE) UCL	101361
99% Chebyshev (MVUE) UCL	152388		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	114919	95% Jackknife UCL	130927
95% Standard Bootstrap UCL	109404	95% Bootstrap-t UCL	13976235
95% Hall's Bootstrap UCL	7287592	95% Percentile Bootstrap UCL	130215
95% BCA Bootstrap UCL	130477		
90% Chebyshev(Mean, Sd) UCL	173518	95% Chebyshev(Mean, Sd) UCL	232280
97.5% Chebyshev(Mean, Sd) UCL	313839	99% Chebyshev(Mean, Sd) UCL	474045

Suggested UCL to Use

95% Hall's Bootstrap UCL 7287592

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	43	Mean	45502
Maximum	270000	Median	705
SD	109982	Std. Error of Mean	44900
Coefficient of Variation	2.417	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.501	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.489	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	135978	95% Adjusted-CLT UCL (Chen-1995)	167330
		95% Modified-t UCL (Johnson-1978)	143461

Gamma GOF Test

A-D Test Statistic	0.951	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.812	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.418	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.365	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.189	k star (bias corrected MLE)	0.206
Theta hat (MLE)	240852	Theta star (bias corrected MLE)	221344
nu hat (MLE)	2.267	nu star (bias corrected)	2.467
MLE Mean (bias corrected)	45502	MLE Sd (bias corrected)	100357
		Approximate Chi Square Value (0.05)	0.234
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	480211	95% Adjusted Gamma UCL (use when n<50)	1017504

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.761	Mean of logged Data	6.796
Maximum of Logged Data	12.51	SD of logged Data	3.149

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	2.620E+12	90% Chebyshev (MVUE) UCL	62834
95% Chebyshev (MVUE) UCL	83611	97.5% Chebyshev (MVUE) UCL	112449
99% Chebyshev (MVUE) UCL	169095		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	119356	95% Jackknife UCL	135978
95% Standard Bootstrap UCL	112654	95% Bootstrap-t UCL	14669033
95% Hall's Bootstrap UCL	8014199	95% Percentile Bootstrap UCL	135133
95% BCA Bootstrap UCL	135622		
90% Chebyshev(Mean, Sd) UCL	180202	95% Chebyshev(Mean, Sd) UCL	241217
97.5% Chebyshev(Mean, Sd) UCL	325903	99% Chebyshev(Mean, Sd) UCL	492253

Suggested UCL to Use

95% Hall's Bootstrap UCL 8014199

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	67	Mean	55661
Maximum	330000	Median	915
SD	134400	Std. Error of Mean	54869
Coefficient of Variation	2.415	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.501	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.488	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	166224	95% Adjusted-CLT UCL (Chen-1995)	204536
		95% Modified-t UCL (Johnson-1978)	175368

Gamma GOF Test

A-D Test Statistic	0.956	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.809	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.416	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.365	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.192	k star (bias corrected MLE)	0.207
Theta hat (MLE)	290141	Theta star (bias corrected MLE)	268853
nu hat (MLE)	2.302	nu star (bias corrected)	2.484
MLE Mean (bias corrected)	55661	MLE Sd (bias corrected)	122330
		Approximate Chi Square Value (0.05)	0.238
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.112

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	581926	95% Adjusted Gamma UCL (use when n<50)	1238152

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.265	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.205	Mean of logged Data	7.066
Maximum of Logged Data	12.71	SD of logged Data	3.11

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	2.006E+12	90% Chebyshev (MVUE) UCL	77506
95% Chebyshev (MVUE) UCL	103104	97.5% Chebyshev (MVUE) UCL	138634
99% Chebyshev (MVUE) UCL	208425		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	145912	95% Jackknife UCL	166224
95% Standard Bootstrap UCL	138952	95% Bootstrap-t UCL	16873971
95% Hall's Bootstrap UCL	9261041	95% Percentile Bootstrap UCL	165302
95% BCA Bootstrap UCL	165638		
90% Chebyshev(Mean, Sd) UCL	220267	95% Chebyshev(Mean, Sd) UCL	294828
97.5% Chebyshev(Mean, Sd) UCL	398315	99% Chebyshev(Mean, Sd) UCL	601596

Suggested UCL to Use

95% Hall's Bootstrap UCL 9261041

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	27	Mean	21950
Maximum	130000	Median	425
SD	52935	Std. Error of Mean	21610
Coefficient of Variation	2.412	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.501	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.489	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	65496	95% Adjusted-CLT UCL (Chen-1995)	80585
		95% Modified-t UCL (Johnson-1978)	69097

Gamma GOF Test

A-D Test Statistic	0.936	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.807	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.42	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.365	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.195	k star (bias corrected MLE)	0.208
Theta hat (MLE)	112725	Theta star (bias corrected MLE)	105289
nu hat (MLE)	2.337	nu star (bias corrected)	2.502
MLE Mean (bias corrected)	21950	MLE Sd (bias corrected)	48073
		Approximate Chi Square Value (0.05)	0.242
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.113

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	227365	95% Adjusted Gamma UCL (use when n<50)	485637

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.273	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.296	Mean of logged Data	6.201
Maximum of Logged Data	11.78	SD of logged Data	3.089

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	6.372E+11	90% Chebyshev (MVUE) UCL	31611
95% Chebyshev (MVUE) UCL	42044	97.5% Chebyshev (MVUE) UCL	56526
99% Chebyshev (MVUE) UCL	84972		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	57495	95% Jackknife UCL	65496
95% Standard Bootstrap UCL	54439	95% Bootstrap-t UCL	5495591
95% Hall's Bootstrap UCL	2979063	95% Percentile Bootstrap UCL	65141
95% BCA Bootstrap UCL	65273		
90% Chebyshev(Mean, Sd) UCL	86781	95% Chebyshev(Mean, Sd) UCL	116147
97.5% Chebyshev(Mean, Sd) UCL	156907	99% Chebyshev(Mean, Sd) UCL	236971

Suggested UCL to Use
95% Hall's Bootstrap UCL 2979063

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	4
Minimum Detect	160	Minimum Non-Detect	21
Maximum Detect	92000	Maximum Non-Detect	200
Variance Detects	4.217E+9	Percent Non-Detects	66.67%
Mean Detects	46080	SD Detects	64941
Median Detects	46080	CV Detects	1.409
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	8.252	SD of Logged Detects	4.493

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	15380	KM Standard Error of Mean	19783
KM SD	34266	95% KM (BCA) UCL	N/A
95% KM (t) UCL	55244	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	47920	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	74730	95% KM Chebyshev UCL	101613
97.5% KM Chebyshev UCL	138926	99% KM Chebyshev UCL	212221

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.28	k star (bias corrected MLE)	N/A
Theta hat (MLE)	164298	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1.122	nu star (bias corrected)	N/A
Mean (detects)	46080		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	15380	SD (KM)	34266
Variance (KM)	1.174E+9	SE of Mean (KM)	19783
k hat (KM)	0.201	k star (KM)	0.212
nu hat (KM)	2.417	nu star (KM)	2.542
theta hat (KM)	76343	theta star (KM)	72601
80% gamma percentile (KM)	20858	90% gamma percentile (KM)	46503
95% gamma percentile (KM)	78044	99% gamma percentile (KM)	164085

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (2.54, α)	0.251	Adjusted Chi Square Value (2.54, β)	0.116
95% Gamma Approximate KM-UCL (use when n>=50)	155904	95% Gamma Adjusted KM-UCL (use when n<50)	335774

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	15360	Mean in Log Scale	0.49
SD in Original Scale	37546	SD in Log Scale	6.401
95% t UCL (assumes normality of ROS data)	46247	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	1.314E+39		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.865	KM Geo Mean	129.7
KM SD (logged)	3.043	95% Critical H Value (KM-Log)	11.56
KM Standard Error of Mean (logged)	1.772	95% H-UCL (KM -Log)	9.092E+10
KM SD (logged)	3.043	95% Critical H Value (KM-Log)	11.56
KM Standard Error of Mean (logged)	1.772		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	15387	Mean in Log Scale	4.927
SD in Original Scale	37533	SD in Log Scale	3.375
95% t UCL (Assumes normality)	46263	95% H-Stat UCL	1.004E+13

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL 212221

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	57	Mean	42155
Maximum	250000	Median	705
SD	101824	Std. Error of Mean	41570
Coefficient of Variation	2.415	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.501	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.489	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	125919	95% Adjusted-CLT UCL (Chen-1995)	154946
		95% Modified-t UCL (Johnson-1978)	132847

Gamma GOF Test

A-D Test Statistic	0.976	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.808	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.424	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.365	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.193	k star (bias corrected MLE)	0.208
Theta hat (MLE)	218232	Theta star (bias corrected MLE)	202966
nu hat (MLE)	2.318	nu star (bias corrected)	2.492
MLE Mean (bias corrected)	42155	MLE Sd (bias corrected)	92498
		Approximate Chi Square Value (0.05)	0.239
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.112

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	438846	95% Adjusted Gamma UCL (use when n<50)	935413

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.847	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.278	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.043	Mean of logged Data	6.819
Maximum of Logged Data	12.43	SD of logged Data	3.063

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	8.330E+11	90% Chebyshev (MVUE) UCL	56308
95% Chebyshev (MVUE) UCL	74878	97.5% Chebyshev (MVUE) UCL	100653
99% Chebyshev (MVUE) UCL	151282		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	110531	95% Jackknife UCL	125919
95% Standard Bootstrap UCL	104366	95% Bootstrap-t UCL	12349486
95% Hall's Bootstrap UCL	5775189	95% Percentile Bootstrap UCL	125203
95% BCA Bootstrap UCL	125563		
90% Chebyshev(Mean, Sd) UCL	166863	95% Chebyshev(Mean, Sd) UCL	223352
97.5% Chebyshev(Mean, Sd) UCL	301757	99% Chebyshev(Mean, Sd) UCL	455767

Suggested UCL to Use

95% Hall's Bootstrap UCL 5775189

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	9.3	Minimum Non-Detect	0.74
Maximum Detect	39000	Maximum Non-Detect	7
Variance Detects	3.781E+8	Percent Non-Detects	33.33%
Mean Detects	9835	SD Detects	19444
Median Detects	165	CV Detects	1.977
Skewness Detects	2	Kurtosis Detects	4
Mean of Logged Detects	5.711	SD of Logged Detects	3.514

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.634	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.439	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	6557	KM Standard Error of Mean	6840
KM SD	14509	95% KM (BCA) UCL	N/A
95% KM (t) UCL	20339	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	17807	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	27076	95% KM Chebyshev UCL	36371
97.5% KM Chebyshev UCL	49271	99% KM Chebyshev UCL	74611

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.532	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.392	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.425	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.21	k star (bias corrected MLE)	0.219
Theta hat (MLE)	46889	Theta star (bias corrected MLE)	44887
nu hat (MLE)	1.678	nu star (bias corrected)	1.753
Mean (detects)	9835		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	6557
Maximum	39000	Median	54.65
SD	15894	CV	2.424
k hat (MLE)	0.122	k star (bias corrected MLE)	0.172
Theta hat (MLE)	53962	Theta star (bias corrected MLE)	38150
nu hat (MLE)	1.458	nu star (bias corrected)	2.062
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (2.06, α)	0.159	Adjusted Chi Square Value (2.06, β)	0.088
95% Gamma Approximate UCL (use when n>=50)	84873	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	6557	SD (KM)	14509
Variance (KM)	2.105E+8	SE of Mean (KM)	6840
k hat (KM)	0.204	k star (KM)	0.213
nu hat (KM)	2.451	nu star (KM)	2.559
theta hat (KM)	32107	theta star (KM)	30751
80% gamma percentile (KM)	8920	90% gamma percentile (KM)	19823
95% gamma percentile (KM)	33213	99% gamma percentile (KM)	69704

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (2.56, α)	0.255	Adjusted Chi Square Value (2.56, β)	0.118
95% Gamma Approximate KM-UCL (use when n>=50)	65882	95% Gamma Adjusted KM-UCL (use when n<50)	142330

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	6557	Mean in Log Scale	2.51
SD in Original Scale	15894	SD in Log Scale	5.658
95% t UCL (assumes normality of ROS data)	19632	95% Percentile Bootstrap UCL	19517
95% BCA Bootstrap UCL	19577	95% Bootstrap t UCL	2104041
95% H-UCL (Log ROS)	3.120E+31		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.707	KM Geo Mean	40.73
KM SD (logged)	3.769	95% Critical H Value (KM-Log)	14.28
KM Standard Error of Mean (logged)	1.777	95% H-UCL (KM -Log)	1.397E+15
KM SD (logged)	3.769	95% Critical H Value (KM-Log)	14.28
KM Standard Error of Mean (logged)	1.777		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	6557	Mean in Log Scale	3.851
SD in Original Scale	15894	SD in Log Scale	4.028
95% t UCL (Assumes normality)	19632	95% H-Stat UCL	1.313E+17

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	N/A	Gamma Adjusted KM-UCL (use if k<=1 and 15<n< 50 but k<=1)	142330

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	3
Minimum Detect	72	Minimum Non-Detect	15
Maximum Detect	30000	Maximum Non-Detect	140
Variance Detects	4.478E+8	Percent Non-Detects	66.67%
Mean Detects	15036	SD Detects	21162
Median Detects	15036	CV Detects	1.407
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	7.293	SD of Logged Detects	4.265

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5024	KM Standard Error of Mean	6449
KM SD	11169	95% KM (BCA) UCL	N/A
95% KM (t) UCL	18019	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	15632	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	24370	95% KM Chebyshev UCL	33134
97.5% KM Chebyshev UCL	45296	99% KM Chebyshev UCL	69188

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.297	k star (bias corrected MLE)	N/A
Theta hat (MLE)	50623	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1.188	nu star (bias corrected)	N/A
Mean (detects)	15036		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5024	SD (KM)	11169
Variance (KM)	1.248E+8	SE of Mean (KM)	6449
k hat (KM)	0.202	k star (KM)	0.212
nu hat (KM)	2.428	nu star (KM)	2.547
theta hat (KM)	24830	theta star (KM)	23668
80% gamma percentile (KM)	6821	90% gamma percentile (KM)	15191
95% gamma percentile (KM)	25481	99% gamma percentile (KM)	53542

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (2.55, α)	0.252	Adjusted Chi Square Value (2.55, β)	0.117
95% Gamma Approximate KM-UCL (use when n>=50)	50787	95% Gamma Adjusted KM-UCL (use when n<50)	109492

Lognormal GOF Test on Detected Observations Only

Not Enough Data to Perform GOF Test

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran (cont.'d)

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5012	Mean in Log Scale	-0.135
SD in Original Scale	12242	SD in Log Scale	6.304
95% t UCL (assumes normality of ROS data)	15082	95% Percentile Bootstrap UCL	15000
95% BCA Bootstrap UCL	15012	95% Bootstrap t UCL	1.034E+9
95% H-UCL (Log ROS)	4.715E+37		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.302	KM Geo Mean	73.82
KM SD (logged)	2.757	95% Critical H Value (KM-Log)	10.5
KM Standard Error of Mean (logged)	1.602	95% H-UCL (KM -Log)	1.383E+9
KM SD (logged)	2.757	95% Critical H Value (KM-Log)	10.5
KM Standard Error of Mean (logged)	1.602		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5031	Mean in Log Scale	4.366
SD in Original Scale	12232	SD in Log Scale	3.081
95% t UCL (Assumes normality)	15094	95% H-Stat UCL	9.123E+10

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL 69188

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	100	Mean	99268
Maximum	590000	Median	1350
SD	240411	Std. Error of Mean	98147
Coefficient of Variation	2.422	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.5	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.489	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	297040	95% Adjusted-CLT UCL (Chen-1995)	365574
		95% Modified-t UCL (Johnson-1978)	313397

Gamma GOF Test

A-D Test Statistic	0.969	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.816	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.425	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.366	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.184	k star (bias corrected MLE)	0.203
Theta hat (MLE)	539423	Theta star (bias corrected MLE)	488707
nu hat (MLE)	2.208	nu star (bias corrected)	2.437
MLE Mean (bias corrected)	99268	MLE Sd (bias corrected)	220257
		Approximate Chi Square Value (0.05)	0.227
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.108

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1064297	95% Adjusted Gamma UCL (use when n<50)	2238391

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.278	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.605	Mean of logged Data	7.455
Maximum of Logged Data	13.29	SD of logged Data	3.179

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	7.647E+12	90% Chebyshev (MVUE) UCL	127203
95% Chebyshev (MVUE) UCL	169301	97.5% Chebyshev (MVUE) UCL	227731
99% Chebyshev (MVUE) UCL	342505		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	260706	95% Jackknife UCL	297040
95% Standard Bootstrap UCL	245000	95% Bootstrap-t UCL	32515000
95% Hall's Bootstrap UCL	21331168	95% Percentile Bootstrap UCL	295283
95% BCA Bootstrap UCL	296033		
90% Chebyshev(Mean, Sd) UCL	393710	95% Chebyshev(Mean, Sd) UCL	527082
97.5% Chebyshev(Mean, Sd) UCL	712198	99% Chebyshev(Mean, Sd) UCL	1075821

Suggested UCL to Use

95% Hall's Bootstrap UCL 21331168

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	30	Mean	20269
Maximum	120000	Median	390
SD	48859	Std. Error of Mean	19947
Coefficient of Variation	2.411	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.501	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.488	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	60462	95% Adjusted-CLT UCL (Chen-1995)	74389
		95% Modified-t UCL (Johnson-1978)	63786

Gamma GOF Test

A-D Test Statistic	0.964	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.804	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.42	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.364	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.198	k star (bias corrected MLE)	0.21
Theta hat (MLE)	102600	Theta star (bias corrected MLE)	96569
nu hat (MLE)	2.371	nu star (bias corrected)	2.519
MLE Mean (bias corrected)	20269	MLE Sd (bias corrected)	44242
		Approximate Chi Square Value (0.05)	0.245
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.114

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	208050	95% Adjusted Gamma UCL (use when n<50)	445993

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.848	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.273	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.401	Mean of logged Data	6.184
Maximum of Logged Data	11.7	SD of logged Data	3.033

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	2.960E+11	90% Chebyshev (MVUE) UCL	28515
95% Chebyshev (MVUE) UCL	37910	97.5% Chebyshev (MVUE) UCL	50950
99% Chebyshev (MVUE) UCL	76564		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	53078	95% Jackknife UCL	60462
95% Standard Bootstrap UCL	49455	95% Bootstrap-t UCL	5295780
95% Hall's Bootstrap UCL	2885700	95% Percentile Bootstrap UCL	60139
95% BCA Bootstrap UCL	80067		
90% Chebyshev(Mean, Sd) UCL	80108	95% Chebyshev(Mean, Sd) UCL	107214
97.5% Chebyshev(Mean, Sd) UCL	144835	99% Chebyshev(Mean, Sd) UCL	218735

Suggested UCL to Use
95% Hall's Bootstrap UCL 2885700

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	8	Minimum Non-Detect	0.92
Maximum Detect	18000	Maximum Non-Detect	8.7
Variance Detects	80585592	Percent Non-Detects	33.33%
Mean Detects	4535	SD Detects	8977
Median Detects	65.5	CV Detects	1.98
Skewness Detects	2	Kurtosis Detects	3.999
Mean of Logged Detects	4.906	SD of Logged Detects	3.437

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.634	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.439	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3024	KM Standard Error of Mean	3157
KM SD	6698	95% KM (BCA) UCL	N/A
95% KM (t) UCL	9386	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	8217	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	12496	95% KM Chebyshev UCL	16786
97.5% KM Chebyshev UCL	22741	99% KM Chebyshev UCL	34438

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.587	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.387	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.425	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.208	k star (bias corrected MLE)	0.219
Theta hat (MLE)	21788	Theta star (bias corrected MLE)	20735
nu hat (MLE)	1.665	nu star (bias corrected)	1.75
Mean (detects)	4535		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3023
Maximum	18000	Median	14.5
SD	7337	CV	2.427
k hat (MLE)	0.126	k star (bias corrected MLE)	0.174
Theta hat (MLE)	24083	Theta star (bias corrected MLE)	17387
nu hat (MLE)	1.506	nu star (bias corrected)	2.087
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (2.09, α)	0.163	Adjusted Chi Square Value (2.09, β)	0.0889
95% Gamma Approximate UCL (use when n>=50)	38729	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3024	SD (KM)	6698
Variance (KM)	44857147	SE of Mean (KM)	3157
k hat (KM)	0.204	k star (KM)	0.213
nu hat (KM)	2.446	nu star (KM)	2.557
theta hat (KM)	14833	theta star (KM)	14194
80% gamma percentile (KM)	4112	90% gamma percentile (KM)	9143
95% gamma percentile (KM)	15322	99% gamma percentile (KM)	32163

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (2.56, α)	0.254	Adjusted Chi Square Value (2.56, β)	0.118
95% Gamma Approximate KM-UCL (use when n>=50)	30419	95% Gamma Adjusted KM-UCL (use when n<50)	65692

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.274	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3023	Mean in Log Scale	2.603
SD in Original Scale	7337	SD in Log Scale	4.515
95% t UCL (assumes normality of ROS data)	9059	95% Percentile Bootstrap UCL	9005
95% BCA Bootstrap UCL	9037	95% Bootstrap t UCL	2359959
95% H-UCL (Log ROS)	3.315E+20		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.423	KM Geo Mean	30.66
KM SD (logged)	3.255	95% Critical H Value (KM-Log)	12.35
KM Standard Error of Mean (logged)	1.555	95% H-UCL (KM -Log)	3.939E+11
KM SD (logged)	3.255	95% Critical H Value (KM-Log)	12.35
KM Standard Error of Mean (logged)	1.555		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3024	Mean in Log Scale	3.386
SD in Original Scale	7337	SD in Log Scale	3.624
95% t UCL (Assumes normality)	9060	95% H-Stat UCL	9.739E+13

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	N/A	Gamma Adjusted KM-UCL (use if k<=1 and 15<n< 50 but k<=1)	65692

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	48	Mean	80320
Maximum	480000	Median	425
SD	195803	Std. Error of Mean	79936
Coefficient of Variation	2.438	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.498	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.491	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	241395	95% Adjusted-CLT UCL (Chen-1995)	297215
		95% Modified-t UCL (Johnson-1978)	254718

Gamma GOF Test

A-D Test Statistic	1.13	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.833	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.45	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.368	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.165	k star (bias corrected MLE)	0.194
Theta hat (MLE)	485905	Theta star (bias corrected MLE)	414530
nu hat (MLE)	1.984	nu star (bias corrected)	2.325
MLE Mean (bias corrected)	80320	MLE Sd (bias corrected)	182469
		Approximate Chi Square Value (0.05)	0.204
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	914436	95% Adjusted Gamma UCL (use when n<50)	1858294

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.317	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.871	Mean of logged Data	6.71
Maximum of Logged Data	13.08	SD of logged Data	3.318

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	2.601E+13	90% Chebyshev (MVUE) UCL	74921
95% Chebyshev (MVUE) UCL	99807	97.5% Chebyshev (MVUE) UCL	134348
99% Chebyshev (MVUE) UCL	202197		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	211803	95% Jackknife UCL	241395
95% Standard Bootstrap UCL	198637	95% Bootstrap-t UCL	82889060
95% Hall's Bootstrap UCL	37315230	95% Percentile Bootstrap UCL	240103
95% BCA Bootstrap UCL	240395		
90% Chebyshev(Mean, Sd) UCL	320128	95% Chebyshev(Mean, Sd) UCL	428753
97.5% Chebyshev(Mean, Sd) UCL	579521	99% Chebyshev(Mean, Sd) UCL	875675

Suggested UCL to Use

95% Hall's Bootstrap UCL 37315230

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	90	Mean	75846
Maximum	450000	Median	1295
SD	183300	Std. Error of Mean	74832
Coefficient of Variation	2.417	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.501	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.489	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	226635	95% Adjusted-CLT UCL (Chen-1995)	278887
		95% Modified-t UCL (Johnson-1978)	239106

Gamma GOF Test

A-D Test Statistic	0.96	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.811	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.426	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.365	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.19	k star (bias corrected MLE)	0.206
Theta hat (MLE)	398799	Theta star (bias corrected MLE)	367819
nu hat (MLE)	2.282	nu star (bias corrected)	2.474
MLE Mean (bias corrected)	75846	MLE Sd (bias corrected)	167025
		Approximate Chi Square Value (0.05)	0.235
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.111

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	797192	95% Adjusted Gamma UCL (use when n<50)	1692226

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.282	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.5	Mean of logged Data	7.337
Maximum of Logged Data	13.02	SD of logged Data	3.119

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	2.983E+12	90% Chebyshev (MVUE) UCL	103049
95% Chebyshev (MVUE) UCL	137093	97.5% Chebyshev (MVUE) UCL	184345
99% Chebyshev (MVUE) UCL	277163		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	198933	95% Jackknife UCL	226635
95% Standard Bootstrap UCL	186674	95% Bootstrap-t UCL	21094476
95% Hall's Bootstrap UCL	12966992	95% Percentile Bootstrap UCL	225312
95% BCA Bootstrap UCL	225815		
90% Chebyshev(Mean, Sd) UCL	300341	95% Chebyshev(Mean, Sd) UCL	402030
97.5% Chebyshev(Mean, Sd) UCL	543170	99% Chebyshev(Mean, Sd) UCL	820412

Suggested UCL to Use

95% Hall's Bootstrap UCL 12966992

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	3500	Mean	6283
Maximum	9800	Median	6050
SD	2122	Std. Error of Mean	866.2
Coefficient of Variation	0.338	Skewness	0.659

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8029	95% Adjusted-CLT UCL (Chen-1995)	7957
		95% Modified-t UCL (Johnson-1978)	8068

Gamma GOF Test

A-D Test Statistic	0.19	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.143	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.53	k star (bias corrected MLE)	5.376
Theta hat (MLE)	596.8	Theta star (bias corrected MLE)	1169
nu hat (MLE)	126.3	nu star (bias corrected)	64.51
MLE Mean (bias corrected)	6283	MLE Sd (bias corrected)	2710
		Approximate Chi Square Value (0.05)	47.03
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	41.69

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8619	95% Adjusted Gamma UCL (use when n<50)	9722

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.984	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.161	Mean of logged Data	8.697
Maximum of Logged Data	9.19	SD of logged Data	0.344

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	9059	90% Chebyshev (MVUE) UCL	8938
95% Chebyshev (MVUE) UCL	10138	97.5% Chebyshev (MVUE) UCL	11804
99% Chebyshev (MVUE) UCL	15076		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7708	95% Jackknife UCL	8029
95% Standard Bootstrap UCL	7601	95% Bootstrap-t UCL	8475
95% Hall's Bootstrap UCL	10937	95% Percentile Bootstrap UCL	7533
95% BCA Bootstrap UCL	7633		
90% Chebyshev(Mean, Sd) UCL	8882	95% Chebyshev(Mean, Sd) UCL	10059
97.5% Chebyshev(Mean, Sd) UCL	11693	99% Chebyshev(Mean, Sd) UCL	14902

Suggested UCL to Use

95% Student's-t UCL	8029

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	1.8	Mean	6
Maximum	9.4	Median	6.05
SD	2.462	Std. Error of Mean	1.005
Coefficient of Variation	0.41	Skewness	-0.68

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8.025	95% Adjusted-CLT UCL (Chen-1995)	7.355
		95% Modified-t UCL (Johnson-1978)	7.979

Gamma GOF Test

A-D Test Statistic	0.633	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.349	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.88	k star (bias corrected MLE)	2.551
Theta hat (MLE)	1.229	Theta star (bias corrected MLE)	2.352
nu hat (MLE)	58.56	nu star (bias corrected)	30.61
MLE Mean (bias corrected)	6	MLE Sd (bias corrected)	3.756
		Approximate Chi Square Value (0.05)	18.98
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	15.76

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	9.68	95% Adjusted Gamma UCL (use when n<50)	11.65

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.782	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.372	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.588	Mean of logged Data	1.686
Maximum of Logged Data	2.241	SD of logged Data	0.568

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	12.92	90% Chebyshev (MVUE) UCL	10.43
95% Chebyshev (MVUE) UCL	12.36	97.5% Chebyshev (MVUE) UCL	15.05
99% Chebyshev (MVUE) UCL	20.32		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7.653	95% Jackknife UCL	8.025
95% Standard Bootstrap UCL	7.524	95% Bootstrap-t UCL	7.643
95% Hall's Bootstrap UCL	7.6	95% Percentile Bootstrap UCL	7.433
95% BCA Bootstrap UCL	7.333		
90% Chebyshev(Mean, Sd) UCL	9.015	95% Chebyshev(Mean, Sd) UCL	10.38
97.5% Chebyshev(Mean, Sd) UCL	12.28	99% Chebyshev(Mean, Sd) UCL	16

Suggested UCL to Use

95% Student's-t UCL	8.025

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	3
Minimum Detect	0.66	Minimum Non-Detect	0.26
Maximum Detect	0.85	Maximum Non-Detect	1.4
Variance Detects	0.0181	Percent Non-Detects	66.67%
Mean Detects	0.755	SD Detects	0.134
Median Detects	0.755	CV Detects	0.178
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.289	SD of Logged Detects	0.179

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.458	KM Standard Error of Mean	0.158
KM SD	0.25	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.776	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.718	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.932	95% KM Chebyshev UCL	1.147
97.5% KM Chebyshev UCL	1.445	99% KM Chebyshev UCL	2.03

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	62.83	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.012	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	251.3	nu star (bias corrected)	N/A
Mean (detects)	0.755		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.458	SD (KM)	0.25
Variance (KM)	0.0624	SE of Mean (KM)	0.158
k hat (KM)	3.361	k star (KM)	1.791
nu hat (KM)	40.33	nu star (KM)	21.5
theta hat (KM)	0.136	theta star (KM)	0.256
80% gamma percentile (KM)	0.695	90% gamma percentile (KM)	0.914
95% gamma percentile (KM)	1.125	99% gamma percentile (KM)	1.596

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (21.50, α)	11.96	Adjusted Chi Square Value (21.50, β)	9.5
95% Gamma Approximate KM-UCL (use when n>=50)	0.823	95% Gamma Adjusted KM-UCL (use when n<50)	1.036

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.513	Mean in Log Scale	-0.729
SD in Original Scale	0.205	SD in Log Scale	0.379
95% t UCL (assumes normality of ROS data)	0.682	95% Percentile Bootstrap UCL	0.645
95% BCA Bootstrap UCL	0.666	95% Bootstrap t UCL	0.887
95% H-UCL (Log ROS)	0.775		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.924	KM Geo Mean	0.397
KM SD (logged)	0.524	95% Critical H Value (KM-Log)	2.697
KM Standard Error of Mean (logged)	0.332	95% H-UCL (KM -Log)	0.858
KM SD (logged)	0.524	95% Critical H Value (KM-Log)	2.697
KM Standard Error of Mean (logged)	0.332		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.435	Mean in Log Scale	-1.163
SD in Original Scale	0.336	SD in Log Scale	0.937
95% t UCL (Assumes normality)	0.712	95% H-Stat UCL	2.477

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.776	KM H-UCL	0.858
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	1.2	Mean	4.583
Maximum	7.9	Median	4.85
SD	2.219	Std. Error of Mean	0.906
Coefficient of Variation	0.484	Skewness	-0.0932

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.409	95% Adjusted-CLT UCL (Chen-1995)	6.037
		95% Modified-t UCL (Johnson-1978)	6.403

Gamma GOF Test

A-D Test Statistic	0.386	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.736	k star (bias corrected MLE)	1.979
Theta hat (MLE)	1.227	Theta star (bias corrected MLE)	2.316
nu hat (MLE)	44.83	nu star (bias corrected)	23.75
MLE Mean (bias corrected)	4.583	MLE Sd (bias corrected)	3.258
		Approximate Chi Square Value (0.05)	13.66
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7.97	95% Adjusted Gamma UCL (use when n<50)	9.898

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.863	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.254	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.182	Mean of logged Data	1.383
Maximum of Logged Data	2.067	SD of logged Data	0.648

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	11.79	90% Chebyshev (MVUE) UCL	8.462
95% Chebyshev (MVUE) UCL	10.15	97.5% Chebyshev (MVUE) UCL	12.5
99% Chebyshev (MVUE) UCL	17.12		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.074	95% Jackknife UCL	6.409
95% Standard Bootstrap UCL	5.945	95% Bootstrap-t UCL	6.365
95% Hall's Bootstrap UCL	6.351	95% Percentile Bootstrap UCL	5.933
95% BCA Bootstrap UCL	5.85		
90% Chebyshev(Mean, Sd) UCL	7.302	95% Chebyshev(Mean, Sd) UCL	8.533
97.5% Chebyshev(Mean, Sd) UCL	10.24	99% Chebyshev(Mean, Sd) UCL	13.6

Suggested UCL to Use

95% Student's-t UCL	6.409

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	10000	Mean	21167
Maximum	54000	Median	14000
SD	16570	Std. Error of Mean	6765
Coefficient of Variation	0.783	Skewness	2.158

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.692	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.334	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	34798	95% Adjusted-CLT UCL (Chen-1995)	38661
		95% Modified-t UCL (Johnson-1978)	35791

Gamma GOF Test

A-D Test Statistic	0.728	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.702	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.343	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.335	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.911	k star (bias corrected MLE)	1.567
Theta hat (MLE)	7271	Theta star (bias corrected MLE)	13511
nu hat (MLE)	34.93	nu star (bias corrected)	18.8
MLE Mean (bias corrected)	21167	MLE Sd (bias corrected)	16911
		Approximate Chi Square Value (0.05)	9.971
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	7.76

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	39907	95% Adjusted Gamma UCL (use when n<50)	51278

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.833	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.316	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.21	Mean of logged Data	9.779
Maximum of Logged Data	10.9	SD of logged Data	0.604

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	46377	90% Chebyshev (MVUE) UCL	35591
95% Chebyshev (MVUE) UCL	42433	97.5% Chebyshev (MVUE) UCL	51930
99% Chebyshev (MVUE) UCL	70585		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	32294	95% Jackknife UCL	34798
95% Standard Bootstrap UCL	31048	95% Bootstrap-t UCL	103909
95% Hall's Bootstrap UCL	112081	95% Percentile Bootstrap UCL	32667
95% BCA Bootstrap UCL	36500		
90% Chebyshev(Mean, Sd) UCL	41461	95% Chebyshev(Mean, Sd) UCL	50653
97.5% Chebyshev(Mean, Sd) UCL	63412	99% Chebyshev(Mean, Sd) UCL	88475

Suggested UCL to Use
95% H-UCL 46377

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	9.1	Mean	186.9
Maximum	1000	Median	24.5
SD	398.6	Std. Error of Mean	162.7
Coefficient of Variation	2.133	Skewness	2.443

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.527	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.469	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	514.8	95% Adjusted-CLT UCL (Chen-1995)	627.9
		95% Modified-t UCL (Johnson-1978)	541.8

Gamma GOF Test

A-D Test Statistic	1.038	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.4	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.352	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.419	k star (bias corrected MLE)	0.321
Theta hat (MLE)	445.5	Theta star (bias corrected MLE)	582.4
nu hat (MLE)	5.033	nu star (bias corrected)	3.85
MLE Mean (bias corrected)	186.9	MLE Sd (bias corrected)	329.9
		Approximate Chi Square Value (0.05)	0.663
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.318

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1084	95% Adjusted Gamma UCL (use when n<50)	2259

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.807	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.282	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.208	Mean of logged Data	3.673
Maximum of Logged Data	6.908	SD of logged Data	1.684

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	22562	90% Chebyshev (MVUE) UCL	320.2
95% Chebyshev (MVUE) UCL	415.2	97.5% Chebyshev (MVUE) UCL	547.1
99% Chebyshev (MVUE) UCL	806		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	454.5	95% Jackknife UCL	514.8
95% Standard Bootstrap UCL	431.1	95% Bootstrap-t UCL	9785
95% Hall's Bootstrap UCL	4339	95% Percentile Bootstrap UCL	509.7
95% BCA Bootstrap UCL	518.7		
90% Chebyshev(Mean, Sd) UCL	675	95% Chebyshev(Mean, Sd) UCL	896.2
97.5% Chebyshev(Mean, Sd) UCL	1203	99% Chebyshev(Mean, Sd) UCL	1806

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	1806

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	370	Mean	1403
Maximum	6000	Median	485
SD	2256	Std. Error of Mean	920.8
Coefficient of Variation	1.607	Skewness	2.432

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.544	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.457	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3259	95% Adjusted-CLT UCL (Chen-1995)	3895
		95% Modified-t UCL (Johnson-1978)	3411

Gamma GOF Test

A-D Test Statistic	1.206	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.718	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.419	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.342	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.873	k star (bias corrected MLE)	0.547
Theta hat (MLE)	1608	Theta star (bias corrected MLE)	2563
nu hat (MLE)	10.47	nu star (bias corrected)	6.57
MLE Mean (bias corrected)	1403	MLE Sd (bias corrected)	1897
		Approximate Chi Square Value (0.05)	1.938
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	1.162

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4758	95% Adjusted Gamma UCL (use when n<50)	7934

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.688	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.347	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.914	Mean of logged Data	6.574
Maximum of Logged Data	8.7	SD of logged Data	1.071

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	10359	90% Chebyshev (MVUE) UCL	2566
95% Chebyshev (MVUE) UCL	3219	97.5% Chebyshev (MVUE) UCL	4126
99% Chebyshev (MVUE) UCL	5908		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	2918	95% Jackknife UCL	3259
95% Standard Bootstrap UCL	2817	95% Bootstrap-t UCL	28337
95% Hall's Bootstrap UCL	21143	95% Percentile Bootstrap UCL	3195
95% BCA Bootstrap UCL	3292		
90% Chebyshev(Mean, Sd) UCL	4166	95% Chebyshev(Mean, Sd) UCL	5417
97.5% Chebyshev(Mean, Sd) UCL	7154	99% Chebyshev(Mean, Sd) UCL	10565

Suggested UCL to Use

95% Hall's Bootstrap UCL 21143

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.11	Minimum Non-Detect	0.046
Maximum Detect	0.25	Maximum Non-Detect	0.046
Variance Detects	0.00343	Percent Non-Detects	16.67%
Mean Detects	0.174	SD Detects	0.0586
Median Detects	0.19	CV Detects	0.337
Skewness Detects	0.0851	Kurtosis Detects	-1.714
Mean of Logged Detects	-1.797	SD of Logged Detects	0.352

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.153	KM Standard Error of Mean	0.0308
KM SD	0.0675	95% KM (BCA) UCL	0.193
95% KM (t) UCL	0.215	95% KM (Percentile Bootstrap) UCL	0.2
95% KM (z) UCL	0.203	95% KM Bootstrap t UCL	0.208
90% KM Chebyshev UCL	0.245	95% KM Chebyshev UCL	0.287
97.5% KM Chebyshev UCL	0.345	99% KM Chebyshev UCL	0.459

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.372	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.253	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.56	k star (bias corrected MLE)	4.357
Theta hat (MLE)	0.0165	Theta star (bias corrected MLE)	0.0399
nu hat (MLE)	105.6	nu star (bias corrected)	43.57
Mean (detects)	0.174		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.047	Mean	0.153
Maximum	0.25	Median	0.155
SD	0.0737	CV	0.482
k hat (MLE)	4.05	k star (bias corrected MLE)	2.136
Theta hat (MLE)	0.0377	Theta star (bias corrected MLE)	0.0716
nu hat (MLE)	48.6	nu star (bias corrected)	25.63
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (25.63, α)	15.1	Adjusted Chi Square Value (25.63, β)	12.28
95% Gamma Approximate UCL (use when n>=50)	0.259	95% Gamma Adjusted UCL (use when n<50)	0.319

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.153	SD (KM)	0.0675
Variance (KM)	0.00456	SE of Mean (KM)	0.0308
k hat (KM)	5.109	k star (KM)	2.665
nu hat (KM)	61.3	nu star (KM)	31.99
theta hat (KM)	0.0299	theta star (KM)	0.0573
80% gamma percentile (KM)	0.221	90% gamma percentile (KM)	0.278
95% gamma percentile (KM)	0.332	99% gamma percentile (KM)	0.449

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (31.99, α)	20.06	Adjusted Chi Square Value (31.99, β)	16.74
95% Gamma Approximate KM-UCL (use when n>=50)	0.243	95% Gamma Adjusted KM-UCL (use when n<50)	0.292

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.156	Mean in Log Scale	-1.945
SD in Original Scale	0.0679	SD in Log Scale	0.48
95% t UCL (assumes normality of ROS data)	0.212	95% Percentile Bootstrap UCL	0.2
95% BCA Bootstrap UCL	0.197	95% Bootstrap t UCL	0.215
95% H-UCL (Log ROS)	0.28		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.011	KM Geo Mean	0.134
KM SD (logged)	0.558	95% Critical H Value (KM-Log)	2.781
KM Standard Error of Mean (logged)	0.255	95% H-UCL (KM -Log)	0.313
KM SD (logged)	0.558	95% Critical H Value (KM-Log)	2.781
KM Standard Error of Mean (logged)	0.255		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.149	Mean in Log Scale	-2.126
SD in Original Scale	0.0809	SD in Log Scale	0.866
95% t UCL (Assumes normality)	0.215	95% H-Stat UCL	0.719

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.215

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	12	Mean	43.17
Maximum	170	Median	19.5
SD	62.24	Std. Error of Mean	25.41
Coefficient of Variation	1.442	Skewness	2.431

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.554	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.466	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	94.37	95% Adjusted-CLT UCL (Chen-1995)	111.9
		95% Modified-t UCL (Johnson-1978)	98.57

Gamma GOF Test

A-D Test Statistic	1.178	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.714	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.449	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.34	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.082	k star (bias corrected MLE)	0.652
Theta hat (MLE)	39.89	Theta star (bias corrected MLE)	66.18
nu hat (MLE)	12.99	nu star (bias corrected)	7.827
MLE Mean (bias corrected)	43.17	MLE Sd (bias corrected)	53.45
		Approximate Chi Square Value (0.05)	2.635
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	1.678

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	128.2	95% Adjusted Gamma UCL (use when n<50)	201.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.716	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.394	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.485	Mean of logged Data	3.237
Maximum of Logged Data	5.136	SD of logged Data	0.956

Table B.3.2

Summary of ProUCL Output for EU03 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/18/2019 1:27:12 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	218.1	90% Chebyshev (MVUE) UCL	78.69
95% Chebyshev (MVUE) UCL	97.78	97.5% Chebyshev (MVUE) UCL	124.3
99% Chebyshev (MVUE) UCL	176.3		

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	84.96	95% Jackknife UCL	94.37
95% Standard Bootstrap UCL	81.94	95% Bootstrap-t UCL	677.6
95% Hall's Bootstrap UCL	515	95% Percentile Bootstrap UCL	93
95% BCA Bootstrap UCL	95.33		
90% Chebyshev(Mean, Sd) UCL	119.4	95% Chebyshev(Mean, Sd) UCL	153.9
97.5% Chebyshev(Mean, Sd) UCL	201.8	99% Chebyshev(Mean, Sd) UCL	296

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	153.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.3

Summary of ProUCL Input Data for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11	12
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Benzo(k)fluoranthene	D_Benzo(k)fluoranthene	Carbazole	D_Carbazole	Chrysene	D_Chrysene	Dibenz(a,h)anthracene
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	260000	1	270000	1	330000	1	130000	1	92000	1	250000	1	39000
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	440	1	680	1	960	1	510	1	200	0	580	1	7
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	1400	1	1500	1	2000	1	790	1	160	1	1400	1	230
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	63	1	59	1	70	1	30	1	21	0	57	1	0.74
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	49	1	43	1	67	1	27	1	22	0	61	1	9.3
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	800	1	730	1	870	1	340	1	81	0	830	1	100
on-site (EU03)	BH152-18	5/29/2018	9-11 ft BGS	5900	1	4800	1	7400	1	2500	1	1800	1	6000	1	670
on-site (EU03)	BH153-18	5/29/2018	13-15 ft BGS	280	1	270	1	410	1	150	1	72	1	340	1	1.9
on-site (EU03)	BH154-18	5/29/2018	13-15 ft BGS	30	1	30	1	47	1	0.74	0	21	0	40	1	0.72
on-site (EU03)	BH155-18	5/29/2018	13-15 ft BGS	28	1	23	1	53.5	1	17	1	22	0	35	1	0.77
on-site (EU03)	BH156-18	5/16/2018	13-15 ft BGS	57	1	52	1	76	1	32	1	24	0	68	1	11
on-site (EU03)	BH157-18	5/17/2018	12-14 ft BGS	130	1	120	1	150	1	67	1	20	0	140	1	19
on-site (EU03)	GP07-18	8/1/2018	12-13 ft bgs													
on-site (EU03)	TT-18	10/1/2008	12 ft BGS									53	0			
on-site (EU03)	TT-18	10/1/2008	12- ft BGS	78	1	73	1	100	1	42	1			80	1	11
on-site (EU03)	TT-18	10/1/2008	5 ft BGS	9.1	0	9.1	0	9.1	0	9.1	0	68	0	9.1	0	9.1
on-site (EU03)	TT-18	10/1/2008	5- ft BGS													

Table B.3.3

Summary of ProUCL Input Data for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				13	14	15	16	17	18	19	20	21	22	23
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	D_Dibenz(a,h)anthracene	Dibenzofuran	D_Dibenzofuran	Fluoranthene	D_Fluoranthene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Naphthalene	D_Naphthalene	Phenanthrene	D_Phenanthrene
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	1	30000	1	590000	1	120000	1	18000	1	480000	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	0	140	0	800	1	410	1	8.7	0	360	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	1	72	1	2700	1	770	1	110	1	940	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	0	15	0	100	1	30	1	0.92	0	48	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	1	15	0	110	1	31	1	8	1	80	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	1	56	0	1900	1	370	1	21	1	490	1
on-site (EU03)	BH152-18	5/29/2018	9-11 ft BGS	1	1700	1	15000	1	2300	1	870	1	15000	1
on-site (EU03)	BH153-18	5/29/2018	13-15 ft BGS	0	37	0	700	1	150	1	2.3	0	510	1
on-site (EU03)	BH154-18	5/29/2018	13-15 ft BGS	0	14	0	56	1	26	1	19	1	45	1
on-site (EU03)	BH155-18	5/29/2018	13-15 ft BGS	0	15	0	38.5	1	24	1	5.3	1	16.45	1
on-site (EU03)	BH156-18	5/16/2018	13-15 ft BGS	1	17	0	110	1	34	1	19	1	57	1
on-site (EU03)	BH157-18	5/17/2018	12-14 ft BGS	1	14	0	250	1	69	1	0.87	0	100	1
on-site (EU03)	GP07-18	8/1/2018	12-13 ft bgs											
on-site (EU03)	TT-18	10/1/2008	12 ft BGS											
on-site (EU03)	TT-18	10/1/2008	12- ft BGS	1	84	1	190	1	45	1	46	1	250	1
on-site (EU03)	TT-18	10/1/2008	5 ft BGS	0	68	0	9.1	0	9.1	0	9.1	0	9.1	0
on-site (EU03)	TT-18	10/1/2008	5- ft BGS											

Table B.3.3

Summary of ProUCL Input Data for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				24	25	26	27	28	29	30	31	32	33	34	35	36	37
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Pyrene	D_Pyrene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	450000	1	5900	1	1.1	1	9.4	1	0.67	1	0.27	0	5.1	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	890	1	9800	1	0.13	1	1.8	1	0.18	1	0.66	1	1.2	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	2300	1	5100	1	0.15	1	6	1	0.23	1	0.85	1	5.3	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	93	1	6200	1	0.13	0	6.1	1	0.26	1	1.4	0	4.6	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	90	1	7200	1	0.59	1	7	1	0.25	1	0.27	0	7.9	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	1700	1	3500	1	0.15	1	5.7	1	0.2	1	0.26	0	3.4	1
on-site (EU03)	BH152-18	5/29/2018	9-11 ft BGS	11000	1	9600	1	5	1	8.7	1	15	1	0.31	1	6.1	1
on-site (EU03)	BH153-18	5/29/2018	13-15 ft BGS	600	1	8700	1	0.16	1	7.6	1	0.22	1	0.27	0	5.5	1
on-site (EU03)	BH154-18	5/29/2018	13-15 ft BGS	53	1	3400	1	0.19	1	7.7	1	0.25	1	0.26	0	3.4	1
on-site (EU03)	BH155-18	5/29/2018	13-15 ft BGS	33.5	1	9050	1	0.175	1	7.85	1	0.215	1	1	1	5.6	1
on-site (EU03)	BH156-18	5/16/2018	13-15 ft BGS	97	1	5800	1	0.23	1	7.5	1	0.25	1	0.31	0	4.5	1
on-site (EU03)	BH157-18	5/17/2018	12-14 ft BGS	220	1	1500	1	0.12	0	5.7	1	0.091	1	0.25	0	2.5	1
on-site (EU03)	GP07-18	8/1/2018	12-13 ft bgs														
on-site (EU03)	TT-18	10/1/2008	12 ft BGS					6.4	0								
on-site (EU03)	TT-18	10/1/2008	12- ft BGS	160	1	2310	1			2.9	1	0.1	1	0.66	1	2.8	1
on-site (EU03)	TT-18	10/1/2008	5 ft BGS	9.1	0							0.68	0				
on-site (EU03)	TT-18	10/1/2008	5- ft BGS			5680	1	0.78	1	17.7	1			1.7	1	4.5	1

Table B.3.3

Summary of ProUCL Input Data for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				38	39	40	41	42	43	44	45	46	47	48	49	50	51
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Iron	D_Iron	Lead	D_Lead	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	22000	1	1000	1	390	1	0.25	1	18	1	20	0	25	0
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	54000	1	14	1	6000	1	0.046	0	170	1	20	0	24	0
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	14000	1	26	1	580	1	0.19	1	22	1	21	0	25	0
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	14000	1	49	1	390	1	0.12	1	16	1	22	0	27	0
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	13000	1	23	1	690	1	0.2	1	21	1	22	0	27	0
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	10000	1	9.1	1	370	1	0.11	1	12	1	20	0	24	0
on-site (EU03)	BH152-18	5/29/2018	9-11 ft BGS	15000	1	550	1	470	1	0.16	1	19	1	23	0	70	1
on-site (EU03)	BH153-18	5/29/2018	13-15 ft BGS	15000	1	68	1	430	1	0.15	1	21	1	980	1	1300	1
on-site (EU03)	BH154-18	5/29/2018	13-15 ft BGS	9800	1	34	1	370	1	0.1	1	10	1	20	0	24	0
on-site (EU03)	BH155-18	5/29/2018	13-15 ft BGS	16000	1	14	1	280	1	0.16	1	22.5	1	22.5	0	26.5	0
on-site (EU03)	BH156-18	5/16/2018	13-15 ft BGS	12000	1	34	1	480	1	0.15	1	15	1	24	0	29	0
on-site (EU03)	BH157-18	5/17/2018	12-14 ft BGS	6300	1	6.8	1	340	1	0.083	1	5.2	1	20	0	25	0
on-site (EU03)	GP07-18	8/1/2018	12-13 ft bgs														
on-site (EU03)	TT-18	10/1/2008	12 ft BGS							0.11	0			35	0	35	0
on-site (EU03)	TT-18	10/1/2008	12- ft BGS	6040	1	9.1	1	297	1			6.2	1				
on-site (EU03)	TT-18	10/1/2008	5 ft BGS											45	0	45	0
on-site (EU03)	TT-18	10/1/2008	5- ft BGS	9890	1	6.4	1	84.9	1	0.54	1	28.2	1				

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	2
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	28	Minimum Non-Detect	9.1
Maximum Detect	260000	Maximum Non-Detect	9.1
Variance Detects	5.172E+9	Percent Non-Detects	7.143%
Mean Detects	20712	SD Detects	71915
Median Detects	130	CV Detects	3.472
Skewness Detects	3.602	Kurtosis Detects	12.98
Mean of Logged Detects	5.757	SD of Logged Detects	2.582

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.324	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.505	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	19233	KM Standard Error of Mean	18580
KM SD	66793	95% KM (BCA) UCL	56052
95% KM (t) UCL	52137	95% KM (Percentile Bootstrap) UCL	56100
95% KM (z) UCL	49795	95% KM Bootstrap t UCL	3306225
90% KM Chebyshev UCL	74974	95% KM Chebyshev UCL	100222
97.5% KM Chebyshev UCL	135266	99% KM Chebyshev UCL	204104

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.361	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.892	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.356	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.264	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.179	k star (bias corrected MLE)	0.189
Theta hat (MLE)	115698	Theta star (bias corrected MLE)	109594
nu hat (MLE)	4.654	nu star (bias corrected)	4.914
Mean (detects)	20712		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	19233
Maximum	260000	Median	104
SD	69315	CV	3.604
k hat (MLE)	0.157	k star (bias corrected MLE)	0.171
Theta hat (MLE)	122169	Theta star (bias corrected MLE)	112267
nu hat (MLE)	4.408	nu star (bias corrected)	4.797
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.80, α)	1.059	Adjusted Chi Square Value (4.80, β)	0.849
95% Gamma Approximate UCL (use when n>=50)	87077	95% Gamma Adjusted UCL (use when n<50)	108660

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	19233	SD (KM)	66793
Variance (KM)	4.461E+9	SE of Mean (KM)	18580
k hat (KM)	0.0829	k star (KM)	0.113
nu hat (KM)	2.322	nu star (KM)	3.157
theta hat (KM)	231962	theta star (KM)	170557
80% gamma percentile (KM)	15675	90% gamma percentile (KM)	53494
95% gamma percentile (KM)	110544	99% gamma percentile (KM)	287475

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.16, α)	0.421	Adjusted Chi Square Value (3.16, β)	0.317
95% Gamma Approximate KM-UCL (use when n>=50)	144399	95% Gamma Adjusted KM-UCL (use when n<50)	191617

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	19233	Mean in Log Scale	5.331
SD in Original Scale	69315	SD in Log Scale	2.948
95% t UCL (assumes normality of ROS data)	52039	95% Percentile Bootstrap UCL	56010
95% BCA Bootstrap UCL	74832	95% Bootstrap t UCL	3591859
95% H-UCL (Log ROS)	3613819		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.503	KM Geo Mean	245.5
KM SD (logged)	2.559	95% Critical H Value (KM-Log)	5.821
KM Standard Error of Mean (logged)	0.712	95% H-UCL (KM -Log)	404117
KM SD (logged)	2.559	95% Critical H Value (KM-Log)	5.821
KM Standard Error of Mean (logged)	0.712		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	19233	Mean in Log Scale	5.454
SD in Original Scale	69315	SD in Log Scale	2.727
95% t UCL (Assumes normality)	52040	95% H-Stat UCL	1025951

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	204104

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	2
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	23	Minimum Non-Detect	9.1
Maximum Detect	270000	Maximum Non-Detect	9.1
Variance Detects	5.580E+9	Percent Non-Detects	7.143%
Mean Detects	21414	SD Detects	74702
Median Detects	120	CV Detects	3.489
Skewness Detects	3.604	Kurtosis Detects	12.99
Mean of Logged Detects	5.724	SD of Logged Detects	2.618

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.322	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.511	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	19885	KM Standard Error of Mean	19300
KM SD	69380	95% KM (BCA) UCL	58339
95% KM (t) UCL	54064	95% KM (Percentile Bootstrap) UCL	58151
95% KM (z) UCL	51630	95% KM Bootstrap t UCL	3398800
90% KM Chebyshev UCL	77784	95% KM Chebyshev UCL	104011
97.5% KM Chebyshev UCL	140412	99% KM Chebyshev UCL	211916

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.336	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.895	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.349	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.264	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.177	k star (bias corrected MLE)	0.187
Theta hat (MLE)	121253	Theta star (bias corrected MLE)	114432
nu hat (MLE)	4.592	nu star (bias corrected)	4.865
Mean (detects)	21414		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	19884
Maximum	270000	Median	96.5
SD	71999	CV	3.621
k hat (MLE)	0.156	k star (bias corrected MLE)	0.17
Theta hat (MLE)	127752	Theta star (bias corrected MLE)	117026
nu hat (MLE)	4.358	nu star (bias corrected)	4.758
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.76, α)	1.042	Adjusted Chi Square Value (4.76, β)	0.834
95% Gamma Approximate UCL (use when n>=50)	90799	95% Gamma Adjusted UCL (use when n<50)	113448

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	19885	SD (KM)	69380
Variance (KM)	4.814E+9	SE of Mean (KM)	19300
k hat (KM)	0.0821	k star (KM)	0.112
nu hat (KM)	2.3	nu star (KM)	3.141
theta hat (KM)	242074	theta star (KM)	177289
80% gamma percentile (KM)	16098	90% gamma percentile (KM)	55211
95% gamma percentile (KM)	114354	99% gamma percentile (KM)	298038

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.14, α)	0.415	Adjusted Chi Square Value (3.14, β)	0.313
95% Gamma Approximate KM-UCL (use when n>=50)	150395	95% Gamma Adjusted KM-UCL (use when n<50)	199681

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	19884	Mean in Log Scale	5.291
SD in Original Scale	71999	SD in Log Scale	2.993
95% t UCL (assumes normality of ROS data)	53962	95% Percentile Bootstrap UCL	58195
95% BCA Bootstrap UCL	77674	95% Bootstrap t UCL	3331049
95% H-UCL (Log ROS)	4657326		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.473	KM Geo Mean	238.2
KM SD (logged)	2.587	95% Critical H Value (KM-Log)	5.879
KM Standard Error of Mean (logged)	0.72	95% H-UCL (KM -Log)	459926
KM SD (logged)	2.587	95% Critical H Value (KM-Log)	5.879
KM Standard Error of Mean (logged)	0.72		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	19885	Mean in Log Scale	5.424
SD in Original Scale	71999	SD in Log Scale	2.755
95% t UCL (Assumes normality)	53962	95% H-Stat UCL	1177940

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	211916

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	2
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	47	Minimum Non-Detect	9.1
Maximum Detect	330000	Maximum Non-Detect	9.1
Variance Detects	8.329E+9	Percent Non-Detects	7.143%
Mean Detects	26323	SD Detects	91266
Median Detects	150	CV Detects	3.467
Skewness Detects	3.602	Kurtosis Detects	12.98
Mean of Logged Detects	6.084	SD of Logged Detects	2.549

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.324	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.505	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	24444	KM Standard Error of Mean	23580
KM SD	84767	95% KM (BCA) UCL	71438
95% KM (t) UCL	66202	95% KM (Percentile Bootstrap) UCL	71010
95% KM (z) UCL	63229	95% KM Bootstrap t UCL	3837060
90% KM Chebyshev UCL	95184	95% KM Chebyshev UCL	127226
97.5% KM Chebyshev UCL	171700	99% KM Chebyshev UCL	259061

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.382	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.889	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.351	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.263	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.182	k star (bias corrected MLE)	0.192
Theta hat (MLE)	144355	Theta star (bias corrected MLE)	137421
nu hat (MLE)	4.741	nu star (bias corrected)	4.98
Mean (detects)	26323		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	24443
Maximum	330000	Median	125
SD	87967	CV	3.599
k hat (MLE)	0.159	k star (bias corrected MLE)	0.173
Theta hat (MLE)	153463	Theta star (bias corrected MLE)	141482
nu hat (MLE)	4.46	nu star (bias corrected)	4.837
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.84, α)	1.078	Adjusted Chi Square Value (4.84, β)	0.865
95% Gamma Approximate UCL (use when n>=50)	109704	95% Gamma Adjusted UCL (use when n<50)	136719

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	24444	SD (KM)	84767
Variance (KM)	7.185E+9	SE of Mean (KM)	23580
k hat (KM)	0.0832	k star (KM)	0.113
nu hat (KM)	2.328	nu star (KM)	3.163
theta hat (KM)	293957	theta star (KM)	216403
80% gamma percentile (KM)	19962	90% gamma percentile (KM)	68023
95% gamma percentile (KM)	140467	99% gamma percentile (KM)	365046

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.16, α)	0.422	Adjusted Chi Square Value (3.16, β)	0.318
95% Gamma Approximate KM-UCL (use when n>=50)	183103	95% Gamma Adjusted KM-UCL (use when n<50)	242936

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.82	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	24443	Mean in Log Scale	5.668
SD in Original Scale	87967	SD in Log Scale	2.903
95% t UCL (assumes normality of ROS data)	66078	95% Percentile Bootstrap UCL	71359
95% BCA Bootstrap UCL	95257	95% Bootstrap t UCL	3860115
95% H-UCL (Log ROS)	3779462		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.808	KM Geo Mean	332.8
KM SD (logged)	2.562	95% Critical H Value (KM-Log)	5.827
KM Standard Error of Mean (logged)	0.713	95% H-UCL (KM -Log)	557518
KM SD (logged)	2.562	95% Critical H Value (KM-Log)	5.827
KM Standard Error of Mean (logged)	0.713		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	24443	Mean in Log Scale	5.758
SD in Original Scale	87967	SD in Log Scale	2.737
95% t UCL (Assumes normality)	66078	95% H-Stat UCL	1468980

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	259061

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	2
Number of Detects	12	Number of Non-Detects	2
Number of Distinct Detects	12	Number of Distinct Non-Detects	2
Minimum Detect	17	Minimum Non-Detect	0.74
Maximum Detect	130000	Maximum Non-Detect	9.1
Variance Detects	1.400E+9	Percent Non-Detects	14.29%
Mean Detects	11209	SD Detects	37416
Median Detects	108.5	CV Detects	3.338
Skewness Detects	3.462	Kurtosis Detects	11.99
Mean of Logged Detects	5.357	SD of Logged Detects	2.56

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.339	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.509	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9608	KM Standard Error of Mean	9323
KM SD	33397	95% KM (BCA) UCL	28191
95% KM (t) UCL	26117	95% KM (Percentile Bootstrap) UCL	27991
95% KM (z) UCL	24942	95% KM Bootstrap t UCL	1394014
90% KM Chebyshev UCL	37575	95% KM Chebyshev UCL	50244
97.5% KM Chebyshev UCL	67827	99% KM Chebyshev UCL	102366

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.094	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.883	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.352	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.273	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.187	k star (bias corrected MLE)	0.196
Theta hat (MLE)	59821	Theta star (bias corrected MLE)	57163
nu hat (MLE)	4.497	nu star (bias corrected)	4.706
Mean (detects)	11209		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	9608
Maximum	130000	Median	54.5
SD	34658	CV	3.607
k hat (MLE)	0.147	k star (bias corrected MLE)	0.163
Theta hat (MLE)	65278	Theta star (bias corrected MLE)	58848
nu hat (MLE)	4.121	nu star (bias corrected)	4.571
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.57, α)	0.96	Adjusted Chi Square Value (4.57, β)	0.763
95% Gamma Approximate UCL (use when n>=50)	45771	95% Gamma Adjusted UCL (use when n<50)	57545

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9608	SD (KM)	33397
Variance (KM)	1.115E+9	SE of Mean (KM)	9323
k hat (KM)	0.0828	k star (KM)	0.113
nu hat (KM)	2.317	nu star (KM)	3.154
theta hat (KM)	116091	theta star (KM)	85292
80% gamma percentile (KM)	7820	90% gamma percentile (KM)	26713
95% gamma percentile (KM)	55227	99% gamma percentile (KM)	143683

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.15, α)	0.419	Adjusted Chi Square Value (3.15, β)	0.316
95% Gamma Approximate KM-UCL (use when n>=50)	72239	95% Gamma Adjusted KM-UCL (use when n<50)	95872

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9608	Mean in Log Scale	4.533
SD in Original Scale	34658	SD in Log Scale	3.152
95% t UCL (assumes normality of ROS data)	26011	95% Percentile Bootstrap UCL	28088
95% BCA Bootstrap UCL	37437	95% Bootstrap t UCL	1448501
95% H-UCL (Log ROS)	6427727		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.549	KM Geo Mean	94.51
KM SD (logged)	3.012	95% Critical H Value (KM-Log)	6.767
KM Standard Error of Mean (logged)	0.841	95% H-UCL (KM -Log)	2510261
KM SD (logged)	3.012	95% Critical H Value (KM-Log)	6.767
KM Standard Error of Mean (logged)	0.841		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9608	Mean in Log Scale	4.629
SD in Original Scale	34658	SD in Log Scale	3.035
95% t UCL (Assumes normality)	26011	95% H-Stat UCL	3186311

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	102366

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	2
Number of Detects	4	Number of Non-Detects	10
Number of Distinct Detects	4	Number of Distinct Non-Detects	8
Minimum Detect	72	Minimum Non-Detect	20
Maximum Detect	92000	Maximum Non-Detect	200
Variance Detects	2.086E+9	Percent Non-Detects	71.43%
Mean Detects	23508	SD Detects	45668
Median Detects	980	CV Detects	1.943
Skewness Detects	1.998	Kurtosis Detects	3.994
Mean of Logged Detects	7.069	SD of Logged Detects	3.213

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.643	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.433	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	6733	KM Standard Error of Mean	7300
KM SD	23653	95% KM (BCA) UCL	N/A
95% KM (t) UCL	19660	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	18739	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	28631	95% KM Chebyshev UCL	38551
97.5% KM Chebyshev UCL	52318	99% KM Chebyshev UCL	79362

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.487	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.328	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.423	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.239	k star (bias corrected MLE)	0.226
Theta hat (MLE)	98426	Theta star (bias corrected MLE)	103845
nu hat (MLE)	1.911	nu star (bias corrected)	1.811
Mean (detects)	23508		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	6717
Maximum	92000	Median	0.01
SD	24551	CV	3.655
k hat (MLE)	0.0825	k star (bias corrected MLE)	0.112
Theta hat (MLE)	81461	Theta star (bias corrected MLE)	59755
nu hat (MLE)	2.309	nu star (bias corrected)	3.147
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (3.15, α)	0.417	Adjusted Chi Square Value (3.15, β)	0.314
95% Gamma Approximate UCL (use when n>=50)	50650	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	6733	SD (KM)	23653
Variance (KM)	5.595E+8	SE of Mean (KM)	7300
k hat (KM)	0.081	k star (KM)	0.111
nu hat (KM)	2.268	nu star (KM)	3.116
theta hat (KM)	83100	theta star (KM)	60504
80% gamma percentile (KM)	5397	90% gamma percentile (KM)	18645
95% gamma percentile (KM)	38748	99% gamma percentile (KM)	101318

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.12, α)	0.408	Adjusted Chi Square Value (3.12, β)	0.307
95% Gamma Approximate KM-UCL (use when n>=50)	51476	95% Gamma Adjusted KM-UCL (use when n<50)	68397

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	6717	Mean in Log Scale	-0.288
SD in Original Scale	24551	SD in Log Scale	5.233
95% t UCL (assumes normality of ROS data)	18337	95% Percentile Bootstrap UCL	19742
95% BCA Bootstrap UCL	26426	95% Bootstrap t UCL	3624264
95% H-UCL (Log ROS)	1.198E+13		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.193	KM Geo Mean	66.19
KM SD (logged)	2.361	95% Critical H Value (KM-Log)	5.41
KM Standard Error of Mean (logged)	0.732	95% H-UCL (KM -Log)	37114
KM SD (logged)	2.361	95% Critical H Value (KM-Log)	5.41
KM Standard Error of Mean (logged)	0.732		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	6736	Mean in Log Scale	4.119
SD in Original Scale	24545	SD in Log Scale	2.563
95% t UCL (Assumes normality)	18353	95% H-Stat UCL	103492

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	N/A	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	68397

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	2
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	35	Minimum Non-Detect	9.1
Maximum Detect	250000	Maximum Non-Detect	9.1
Variance Detects	4.779E+9	Percent Non-Detects	7.143%
Mean Detects	19972	SD Detects	69134
Median Detects	140	CV Detects	3.462
Skewness Detects	3.602	Kurtosis Detects	12.98
Mean of Logged Detects	5.864	SD of Logged Detects	2.52

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.325	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.503	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	18546	KM Standard Error of Mean	17862
KM SD	64212	95% KM (BCA) UCL	54144
95% KM (t) UCL	50178	95% KM (Percentile Bootstrap) UCL	53828
95% KM (z) UCL	47926	95% KM Bootstrap t UCL	3147558
90% KM Chebyshev UCL	72132	95% KM Chebyshev UCL	96405
97.5% KM Chebyshev UCL	130094	99% KM Chebyshev UCL	196271

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.372	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.887	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.361	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.263	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.185	k star (bias corrected MLE)	0.193
Theta hat (MLE)	108238	Theta star (bias corrected MLE)	103363
nu hat (MLE)	4.797	nu star (bias corrected)	5.024
Mean (detects)	19972		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	18545
Maximum	250000	Median	110
SD	66636	CV	3.593
k hat (MLE)	0.161	k star (bias corrected MLE)	0.174
Theta hat (MLE)	114924	Theta star (bias corrected MLE)	106331
nu hat (MLE)	4.518	nu star (bias corrected)	4.883
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.88, α)	1.099	Adjusted Chi Square Value (4.88, β)	0.883
95% Gamma Approximate UCL (use when n>=50)	82427	95% Gamma Adjusted UCL (use when n<50)	102576

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	18546	SD (KM)	64212
Variance (KM)	4.123E+9	SE of Mean (KM)	17862
k hat (KM)	0.0834	k star (KM)	0.113
nu hat (KM)	2.336	nu star (KM)	3.169
theta hat (KM)	222323	theta star (KM)	163887
80% gamma percentile (KM)	15180	90% gamma percentile (KM)	51639
95% gamma percentile (KM)	106553	99% gamma percentile (KM)	276704

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.17, α)	0.424	Adjusted Chi Square Value (3.17, β)	0.32
95% Gamma Approximate KM-UCL (use when n>=50)	138576	95% Gamma Adjusted KM-UCL (use when n<50)	183824

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.83	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	18545	Mean in Log Scale	5.45
SD in Original Scale	66636	SD in Log Scale	2.874
95% t UCL (assumes normality of ROS data)	50084	95% Percentile Bootstrap UCL	54080
95% BCA Bootstrap UCL	72427	95% Bootstrap t UCL	3034742
95% H-UCL (Log ROS)	2524489		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.603	KM Geo Mean	271.1
KM SD (logged)	2.516	95% Critical H Value (KM-Log)	5.732
KM Standard Error of Mean (logged)	0.7	95% H-UCL (KM -Log)	350939
KM SD (logged)	2.516	95% Critical H Value (KM-Log)	5.732
KM Standard Error of Mean (logged)	0.7		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	18545	Mean in Log Scale	5.553
SD in Original Scale	66636	SD in Log Scale	2.686
95% t UCL (Assumes normality)	50084	95% H-Stat UCL	884828

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	196271

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	2
Number of Detects	8	Number of Non-Detects	6
Number of Distinct Detects	7	Number of Distinct Non-Detects	6
Minimum Detect	9.3	Minimum Non-Detect	0.72
Maximum Detect	39000	Maximum Non-Detect	9.1
Variance Detects	1.887E+8	Percent Non-Detects	42.86%
Mean Detects	5006	SD Detects	13737
Median Detects	59.5	CV Detects	2.744
Skewness Detects	2.827	Kurtosis Detects	7.994
Mean of Logged Detects	4.637	SD of Logged Detects	2.88

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.431	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.499	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2861	KM Standard Error of Mean	2864
KM SD	10025	95% KM (BCA) UCL	8410
95% KM (t) UCL	7933	95% KM (Percentile Bootstrap) UCL	8419
95% KM (z) UCL	7572	95% KM Bootstrap t UCL	459012
90% KM Chebyshev UCL	11454	95% KM Chebyshev UCL	15346
97.5% KM Chebyshev UCL	20748	99% KM Chebyshev UCL	31359

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.251	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.844	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.338	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.324	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.191	k star (bias corrected MLE)	0.203
Theta hat (MLE)	26219	Theta star (bias corrected MLE)	24701
nu hat (MLE)	3.055	nu star (bias corrected)	3.243
Mean (detects)	5006		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2861
Maximum	39000	Median	10.15
SD	10403	CV	3.637
k hat (MLE)	0.11	k star (bias corrected MLE)	0.134
Theta hat (MLE)	25975	Theta star (bias corrected MLE)	21324
nu hat (MLE)	3.084	nu star (bias corrected)	3.756
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (3.76, α)	0.628	Adjusted Chi Square Value (3.76, β)	0.484
95% Gamma Approximate UCL (use when n>=50)	17115	95% Gamma Adjusted UCL (use when n<50)	22193

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2861	SD (KM)	10025
Variance (KM)	1.005E+8	SE of Mean (KM)	2864
k hat (KM)	0.0815	k star (KM)	0.112
nu hat (KM)	2.281	nu star (KM)	3.125
theta hat (KM)	35125	theta star (KM)	25632
80% gamma percentile (KM)	2302	90% gamma percentile (KM)	7931
95% gamma percentile (KM)	16461	99% gamma percentile (KM)	42988

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.13, α)	0.41	Adjusted Chi Square Value (3.13, β)	0.309
95% Gamma Approximate KM-UCL (use when n>=50)	21783	95% Gamma Adjusted KM-UCL (use when n<50)	28935

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.837	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2861	Mean in Log Scale	1.403
SD in Original Scale	10403	SD in Log Scale	4.413
95% t UCL (assumes normality of ROS data)	7785	95% Percentile Bootstrap UCL	8409
95% BCA Bootstrap UCL	11291	95% Bootstrap t UCL	465734
95% H-UCL (Log ROS)	1.045E+10		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.509	KM Geo Mean	12.29
KM SD (logged)	3.191	95% Critical H Value (KM-Log)	7.145
KM Standard Error of Mean (logged)	0.912	95% H-UCL (KM -Log)	1114579
KM SD (logged)	3.191	95% Critical H Value (KM-Log)	7.145
KM Standard Error of Mean (logged)	0.912		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2861	Mean in Log Scale	2.631
SD in Original Scale	10403	SD in Log Scale	3.28
95% t UCL (Assumes normality)	7785	95% H-Stat UCL	2385067

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	31359

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran

General Statistics

Total Number of Observations	14	Number of Distinct Observations	11
		Number of Missing Observations	2
Number of Detects	4	Number of Non-Detects	10
Number of Distinct Detects	4	Number of Distinct Non-Detects	7
Minimum Detect	72	Minimum Non-Detect	14
Maximum Detect	30000	Maximum Non-Detect	140
Variance Detects	2.164E+8	Percent Non-Detects	71.43%
Mean Detects	7964	SD Detects	14711
Median Detects	892	CV Detects	1.847
Skewness Detects	1.984	Kurtosis Detects	3.944
Mean of Logged Detects	6.614	SD of Logged Detects	2.861

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.669	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.415	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2286	KM Standard Error of Mean	2376
KM SD	7698	95% KM (BCA) UCL	N/A
95% KM (t) UCL	6494	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	6194	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	9414	95% KM Chebyshev UCL	12642
97.5% KM Chebyshev UCL	17123	99% KM Chebyshev UCL	25925

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.454	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.706	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.295	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.419	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.292	k star (bias corrected MLE)	0.24
Theta hat (MLE)	27245	Theta star (bias corrected MLE)	33219
nu hat (MLE)	2.339	nu star (bias corrected)	1.918
Mean (detects)	7964		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2275
Maximum	30000	Median	0.01
SD	7992	CV	3.512
k hat (MLE)	0.0901	k star (bias corrected MLE)	0.118
Theta hat (MLE)	25254	Theta star (bias corrected MLE)	19216
nu hat (MLE)	2.523	nu star (bias corrected)	3.316
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (3.32, α)	0.472	Adjusted Chi Square Value (3.32, β)	0.357
95% Gamma Approximate UCL (use when n>=50)	15993	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2286	SD (KM)	7698
Variance (KM)	59266250	SE of Mean (KM)	2376
k hat (KM)	0.0882	k star (KM)	0.117
nu hat (KM)	2.469	nu star (KM)	3.274
theta hat (KM)	25923	theta star (KM)	19555
80% gamma percentile (KM)	1946	90% gamma percentile (KM)	6430
95% gamma percentile (KM)	13088	99% gamma percentile (KM)	33544

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.27, α)	0.458	Adjusted Chi Square Value (3.27, β)	0.346
95% Gamma Approximate KM-UCL (use when n>=50)	16345	95% Gamma Adjusted KM-UCL (use when n<50)	21604

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.277	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2276	Mean in Log Scale	-0.229
SD in Original Scale	7992	SD in Log Scale	4.939
95% t UCL (assumes normality of ROS data)	6058	95% Percentile Bootstrap UCL	6446
95% BCA Bootstrap UCL	8699	95% Bootstrap t UCL	640110
95% H-UCL (Log ROS)	4.684E+11		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.797	KM Geo Mean	44.56
KM SD (logged)	2.228	95% Critical H Value (KM-Log)	5.138
KM Standard Error of Mean (logged)	0.69	95% H-UCL (KM -Log)	12776
KM SD (logged)	2.228	95% Critical H Value (KM-Log)	5.138
KM Standard Error of Mean (logged)	0.69		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2289	Mean in Log Scale	3.754
SD in Original Scale	7988	SD in Log Scale	2.428
95% t UCL (Assumes normality)	6070	95% H-Stat UCL	34211

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	N/A	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	21604

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	2
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	12	Number of Distinct Non-Detects	1
Minimum Detect	38.5	Minimum Non-Detect	9.1
Maximum Detect	590000	Maximum Non-Detect	9.1
Variance Detects	2.663E+10	Percent Non-Detects	7.143%
Mean Detects	47073	SD Detects	163179
Median Detects	250	CV Detects	3.466
Skewness Detects	3.602	Kurtosis Detects	12.98
Mean of Logged Detects	6.465	SD of Logged Detects	2.672

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.325	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.501	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	43712	KM Standard Error of Mean	42160
KM SD	151560	95% KM (BCA) UCL	127763
95% KM (t) UCL	118375	95% KM (Percentile Bootstrap) UCL	127103
95% KM (z) UCL	113059	95% KM Bootstrap t UCL	8782718
90% KM Chebyshev UCL	170192	95% KM Chebyshev UCL	227484
97.5% KM Chebyshev UCL	307002	99% KM Chebyshev UCL	463200

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.278	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.896	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.364	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.264	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.175	k star (bias corrected MLE)	0.186
Theta hat (MLE)	269116	Theta star (bias corrected MLE)	253307
nu hat (MLE)	4.548	nu star (bias corrected)	4.832
Mean (detects)	47073		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	43711
Maximum	590000	Median	220
SD	157282	CV	3.598
k hat (MLE)	0.153	k star (bias corrected MLE)	0.168
Theta hat (MLE)	285816	Theta star (bias corrected MLE)	260523
nu hat (MLE)	4.282	nu star (bias corrected)	4.698
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.70, α)	1.015	Adjusted Chi Square Value (4.70, β)	0.811
95% Gamma Approximate UCL (use when n>=50)	202265	95% Gamma Adjusted UCL (use when n<50)	253212

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	43712	SD (KM)	151560
Variance (KM)	2.297E+10	SE of Mean (KM)	42160
k hat (KM)	0.0832	k star (KM)	0.113
nu hat (KM)	2.329	nu star (KM)	3.163
theta hat (KM)	525501	theta star (KM)	386913
80% gamma percentile (KM)	35706	90% gamma percentile (KM)	121649
95% gamma percentile (KM)	251187	99% gamma percentile (KM)	652733

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.16, α)	0.422	Adjusted Chi Square Value (3.16, β)	0.318
95% Gamma Approximate KM-UCL (use when n>=50)	327353	95% Gamma Adjusted KM-UCL (use when n<50)	434314

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	43711	Mean in Log Scale	6.02
SD in Original Scale	157282	SD in Log Scale	3.06
95% t UCL (assumes normality of ROS data)	118153	95% Percentile Bootstrap UCL	127746
95% BCA Bootstrap UCL	171095	95% Bootstrap t UCL	8430021
95% H-UCL (Log ROS)	15154813		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	6.161	KM Geo Mean	473.7
KM SD (logged)	2.706	95% Critical H Value (KM-Log)	6.126
KM Standard Error of Mean (logged)	0.753	95% H-UCL (KM -Log)	1831232
KM SD (logged)	2.706	95% Critical H Value (KM-Log)	6.126
KM Standard Error of Mean (logged)	0.753		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	43711	Mean in Log Scale	6.111
SD in Original Scale	157282	SD in Log Scale	2.888
95% t UCL (Assumes normality)	118153	95% H-Stat UCL	5366450

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	463200

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	2
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	24	Minimum Non-Detect	9.1
Maximum Detect	120000	Maximum Non-Detect	9.1
Variance Detects	1.102E+9	Percent Non-Detects	7.143%
Mean Detects	9558	SD Detects	33189
Median Detects	69	CV Detects	3.472
Skewness Detects	3.603	Kurtosis Detects	12.99
Mean of Logged Detects	5.22	SD of Logged Detects	2.447

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.323	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.51	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8876	KM Standard Error of Mean	8575
KM SD	30826	95% KM (BCA) UCL	25801
95% KM (t) UCL	24062	95% KM (Percentile Bootstrap) UCL	25878
95% KM (z) UCL	22981	95% KM Bootstrap t UCL	1251276
90% KM Chebyshev UCL	34601	95% KM Chebyshev UCL	46254
97.5% KM Chebyshev UCL	62427	99% KM Chebyshev UCL	94196

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.463	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.884	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.354	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.263	Detected Data Not Gamma Distributed at 5% Significance Level	

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.188	k star (bias corrected MLE)	0.196
Theta hat (MLE)	50763	Theta star (bias corrected MLE)	48737
nu hat (MLE)	4.896	nu star (bias corrected)	5.099
Mean (detects)	9558		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	8876
Maximum	120000	Median	57
SD	31990	CV	3.604
k hat (MLE)	0.166	k star (bias corrected MLE)	0.178
Theta hat (MLE)	53585	Theta star (bias corrected MLE)	49930
nu hat (MLE)	4.638	nu star (bias corrected)	4.977
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.98, α)	1.142	Adjusted Chi Square Value (4.98, β)	0.92
95% Gamma Approximate UCL (use when n>=50)	38693	95% Gamma Adjusted UCL (use when n<50)	48013

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8876	SD (KM)	30826
Variance (KM)	9.502E+8	SE of Mean (KM)	8575
k hat (KM)	0.0829	k star (KM)	0.113
nu hat (KM)	2.322	nu star (KM)	3.157
theta hat (KM)	107052	theta star (KM)	78714
80% gamma percentile (KM)	7234	90% gamma percentile (KM)	24688
95% gamma percentile (KM)	51017	99% gamma percentile (KM)	132672

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.16, α)	0.421	Adjusted Chi Square Value (3.16, β)	0.317
95% Gamma Approximate KM-UCL (use when n>=50)	66642	95% Gamma Adjusted KM-UCL (use when n<50)	88433

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.805	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8876	Mean in Log Scale	4.824
SD in Original Scale	31990	SD in Log Scale	2.779
95% t UCL (assumes normality of ROS data)	24016	95% Percentile Bootstrap UCL	25900
95% BCA Bootstrap UCL	34578	95% Bootstrap t UCL	1328939
95% H-UCL (Log ROS)	748040		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.005	KM Geo Mean	149.2
KM SD (logged)	2.394	95% Critical H Value (KM-Log)	5.479
KM Standard Error of Mean (logged)	0.666	95% H-UCL (KM -Log)	99640
KM SD (logged)	2.394	95% Critical H Value (KM-Log)	5.479
KM Standard Error of Mean (logged)	0.666		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8876	Mean in Log Scale	4.955
SD in Original Scale	31989	SD in Log Scale	2.551
95% t UCL (Assumes normality)	24017	95% H-Stat UCL	222681

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	94196

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	2
Number of Detects	9	Number of Non-Detects	5
Number of Distinct Detects	8	Number of Distinct Non-Detects	5
Minimum Detect	5.3	Minimum Non-Detect	0.87
Maximum Detect	18000	Maximum Non-Detect	9.1
Variance Detects	35530643	Percent Non-Detects	35.71%
Mean Detects	2122	SD Detects	5961
Median Detects	21	CV Detects	2.809
Skewness Detects	2.988	Kurtosis Detects	8.943
Mean of Logged Detects	4.197	SD of Logged Detects	2.591

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.418	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.472	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1365	KM Standard Error of Mean	1309
KM SD	4619	95% KM (BCA) UCL	3934
95% KM (t) UCL	3684	95% KM (Percentile Bootstrap) UCL	3927
95% KM (z) UCL	3519	95% KM Bootstrap t UCL	220290
90% KM Chebyshev UCL	5293	95% KM Chebyshev UCL	7072
97.5% KM Chebyshev UCL	9542	99% KM Chebyshev UCL	14393

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.436	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.843	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.357	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.308	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.211	k star (bias corrected MLE)	0.215
Theta hat (MLE)	10067	Theta star (bias corrected MLE)	9889
nu hat (MLE)	3.794	nu star (bias corrected)	3.863
Mean (detects)	2122		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1364
Maximum	18000	Median	13.5
SD	4794	CV	3.514
k hat (MLE)	0.128	k star (bias corrected MLE)	0.148
Theta hat (MLE)	10694	Theta star (bias corrected MLE)	9227
nu hat (MLE)	3.572	nu star (bias corrected)	4.14
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.14, α)	0.778	Adjusted Chi Square Value (4.14, β)	0.609
95% Gamma Approximate UCL (use when n>=50)	7262	95% Gamma Adjusted UCL (use when n<50)	9274

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1365	SD (KM)	4619
Variance (KM)	21335336	SE of Mean (KM)	1309
k hat (KM)	0.0873	k star (KM)	0.116
nu hat (KM)	2.445	nu star (KM)	3.254
theta hat (KM)	15633	theta star (KM)	11744
80% gamma percentile (KM)	1153	90% gamma percentile (KM)	3831
95% gamma percentile (KM)	7818	99% gamma percentile (KM)	20086

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.25, α)	0.451	Adjusted Chi Square Value (3.25, β)	0.341
95% Gamma Approximate KM-UCL (use when n>=50)	9836	95% Gamma Adjusted KM-UCL (use when n<50)	13010

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1364	Mean in Log Scale	2.191
SD in Original Scale	4794	SD in Log Scale	3.482
95% t UCL (assumes normality of ROS data)	3633	95% Percentile Bootstrap UCL	3886
95% BCA Bootstrap UCL	5276	95% Bootstrap t UCL	224693
95% H-UCL (Log ROS)	6930254		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.764	KM Geo Mean	15.86
KM SD (logged)	2.781	95% Critical H Value (KM-Log)	6.283
KM Standard Error of Mean (logged)	0.798	95% H-UCL (KM -Log)	96465
KM SD (logged)	2.781	95% Critical H Value (KM-Log)	6.283
KM Standard Error of Mean (logged)	0.798		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1365	Mean in Log Scale	2.807
SD in Original Scale	4793	SD in Log Scale	2.879
95% t UCL (Assumes normality)	3634	95% H-Stat UCL	186037

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	14393

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	2
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	16.45	Minimum Non-Detect	9.1
Maximum Detect	480000	Maximum Non-Detect	9.1
Variance Detects	1.763E+10	Percent Non-Detects	7.143%
Mean Detects	38300	SD Detects	132777
Median Detects	250	CV Detects	3.467
Skewness Detects	3.6	Kurtosis Detects	12.97
Mean of Logged Detects	5.914	SD of Logged Detects	2.771

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.326	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.493	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	35565	KM Standard Error of Mean	34305
KM SD	123323	95% KM (BCA) UCL	104052
95% KM (t) UCL	96317	95% KM (Percentile Bootstrap) UCL	103112
95% KM (z) UCL	91992	95% KM Bootstrap t UCL	17029105
90% KM Chebyshev UCL	138480	95% KM Chebyshev UCL	185098
97.5% KM Chebyshev UCL	249801	99% KM Chebyshev UCL	376897

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.453	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.906	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.41	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.265	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.164	k star (bias corrected MLE)	0.177
Theta hat (MLE)	234124	Theta star (bias corrected MLE)	216238
nu hat (MLE)	4.253	nu star (bias corrected)	4.605
Mean (detects)	38300		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	35564
Maximum	480000	Median	175
SD	127978	CV	3.599
k hat (MLE)	0.145	k star (bias corrected MLE)	0.162
Theta hat (MLE)	244843	Theta star (bias corrected MLE)	219876
nu hat (MLE)	4.067	nu star (bias corrected)	4.529
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.53, α)	0.941	Adjusted Chi Square Value (4.53, β)	0.747
95% Gamma Approximate UCL (use when n>=50)	171147	95% Gamma Adjusted UCL (use when n<50)	215485

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	35565	SD (KM)	123323
Variance (KM)	1.521E+10	SE of Mean (KM)	34305
k hat (KM)	0.0832	k star (KM)	0.113
nu hat (KM)	2.329	nu star (KM)	3.163
theta hat (KM)	427629	theta star (KM)	314830
80% gamma percentile (KM)	29048	90% gamma percentile (KM)	98973
95% gamma percentile (KM)	204373	99% gamma percentile (KM)	531102

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.16, α)	0.422	Adjusted Chi Square Value (3.16, β)	0.318
95% Gamma Approximate KM-UCL (use when n>=50)	266376	95% Gamma Adjusted KM-UCL (use when n<50)	353416

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.223	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	35564	Mean in Log Scale	5.461
SD in Original Scale	127978	SD in Log Scale	3.157
95% t UCL (assumes normality of ROS data)	96136	95% Percentile Bootstrap UCL	103137
95% BCA Bootstrap UCL	139437	95% Bootstrap t UCL	17024000
95% H-UCL (Log ROS)	16797499		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.65	KM Geo Mean	284.2
KM SD (logged)	2.737	95% Critical H Value (KM-Log)	6.191
KM Standard Error of Mean (logged)	0.761	95% H-UCL (KM -Log)	1325027
KM SD (logged)	2.737	95% Critical H Value (KM-Log)	6.191
KM Standard Error of Mean (logged)	0.761		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	35564	Mean in Log Scale	5.6
SD in Original Scale	127978	SD in Log Scale	2.91
95% t UCL (Assumes normality)	96137	95% H-Stat UCL	3709916

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	376897

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	2
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	33.5	Minimum Non-Detect	9.1
Maximum Detect	450000	Maximum Non-Detect	9.1
Variance Detects	1.549E+10	Percent Non-Detects	7.143%
Mean Detects	35941	SD Detects	124445
Median Detects	220	CV Detects	3.462
Skewness Detects	3.602	Kurtosis Detects	12.98
Mean of Logged Detects	6.327	SD of Logged Detects	2.624

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.325	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.503	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	33375	KM Standard Error of Mean	32153
KM SD	115584	95% KM (BCA) UCL	97787
95% KM (t) UCL	90315	95% KM (Percentile Bootstrap) UCL	97350
95% KM (z) UCL	86261	95% KM Bootstrap t UCL	5877032
90% KM Chebyshev UCL	129832	95% KM Chebyshev UCL	173525
97.5% KM Chebyshev UCL	234168	99% KM Chebyshev UCL	353289

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.247	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.892	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.362	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.264	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.18	k star (bias corrected MLE)	0.19
Theta hat (MLE)	199985	Theta star (bias corrected MLE)	189635
nu hat (MLE)	4.673	nu star (bias corrected)	4.928
Mean (detects)	35941		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	33374
Maximum	450000	Median	190
SD	119948	CV	3.594
k hat (MLE)	0.157	k star (bias corrected MLE)	0.171
Theta hat (MLE)	212832	Theta star (bias corrected MLE)	195368
nu hat (MLE)	4.391	nu star (bias corrected)	4.783
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.78, α)	1.053	Adjusted Chi Square Value (4.78, β)	0.844
95% Gamma Approximate UCL (use when n>=50)	151549	95% Gamma Adjusted UCL (use when n<50)	189195

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	33375	SD (KM)	115584
Variance (KM)	1.336E+10	SE of Mean (KM)	32153
k hat (KM)	0.0834	k star (KM)	0.113
nu hat (KM)	2.335	nu star (KM)	3.168
theta hat (KM)	400295	theta star (KM)	295017
80% gamma percentile (KM)	27307	90% gamma percentile (KM)	92921
95% gamma percentile (KM)	191759	99% gamma percentile (KM)	498029

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.17, α)	0.424	Adjusted Chi Square Value (3.17, β)	0.319
95% Gamma Approximate KM-UCL (use when n>=50)	249481	95% Gamma Adjusted KM-UCL (use when n<50)	330952

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.866	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.177	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	33374	Mean in Log Scale	5.889
SD in Original Scale	119948	SD in Log Scale	3.007
95% t UCL (assumes normality of ROS data)	90146	95% Percentile Bootstrap UCL	97444
95% BCA Bootstrap UCL	129814	95% Bootstrap t UCL	5645448
95% H-UCL (Log ROS)	9307272		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	6.033	KM Geo Mean	416.8
KM SD (logged)	2.651	95% Critical H Value (KM-Log)	6.011
KM Standard Error of Mean (logged)	0.737	95% H-UCL (KM -Log)	1161963
KM SD (logged)	2.651	95% Critical H Value (KM-Log)	6.011
KM Standard Error of Mean (logged)	0.737		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	33374	Mean in Log Scale	5.983
SD in Original Scale	119948	SD in Log Scale	2.83
95% t UCL (Assumes normality)	90146	95% H-Stat UCL	3270219

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	353289

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	3
Minimum	1500	Mean	5981
Maximum	9800	Median	5850
SD	2679	Std. Error of Mean	716
Coefficient of Variation	0.448	Skewness	-0.0878

Normal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.131	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7249	95% Adjusted-CLT UCL (Chen-1995)	7141
		95% Modified-t UCL (Johnson-1978)	7247

Gamma GOF Test

A-D Test Statistic	0.397	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.166	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.23	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.243	k star (bias corrected MLE)	3.382
Theta hat (MLE)	1410	Theta star (bias corrected MLE)	1769
nu hat (MLE)	118.8	nu star (bias corrected)	94.69
MLE Mean (bias corrected)	5981	MLE Sd (bias corrected)	3253
		Approximate Chi Square Value (0.05)	73.24
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	70.74

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7733	95% Adjusted Gamma UCL (use when n<50)	8006

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.313	Mean of logged Data	8.574
Maximum of Logged Data	9.19	SD of logged Data	0.559

Assuming Lognormal Distribution

95% H-UCL	8570	90% Chebyshev (MVUE) UCL	8940
95% Chebyshev (MVUE) UCL	10223	97.5% Chebyshev (MVUE) UCL	12003
99% Chebyshev (MVUE) UCL	15499		

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7159	95% Jackknife UCL	7249
95% Standard Bootstrap UCL	7135	95% Bootstrap-t UCL	7204
95% Hall's Bootstrap UCL	7176	95% Percentile Bootstrap UCL	7139
95% BCA Bootstrap UCL	7058		
90% Chebyshev(Mean, Sd) UCL	8129	95% Chebyshev(Mean, Sd) UCL	9102
97.5% Chebyshev(Mean, Sd) UCL	10453	99% Chebyshev(Mean, Sd) UCL	13106

Suggested UCL to Use

95% Student's-t UCL	7249

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	3
Number of Detects	11	Number of Non-Detects	3
Number of Distinct Detects	10	Number of Distinct Non-Detects	3
Minimum Detect	0.13	Minimum Non-Detect	0.12
Maximum Detect	5	Maximum Non-Detect	6.4
Variance Detects	2.056	Percent Non-Detects	21.43%
Mean Detects	0.787	SD Detects	1.434
Median Detects	0.19	CV Detects	1.823
Skewness Detects	3.032	Kurtosis Detects	9.539
Mean of Logged Detects	-1.056	SD of Logged Detects	1.156

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.514	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.323	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.684	KM Standard Error of Mean	0.372
KM SD	1.281	95% KM (BCA) UCL	1.376
95% KM (t) UCL	1.344	95% KM (Percentile Bootstrap) UCL	1.323
95% KM (z) UCL	1.297	95% KM Bootstrap t UCL	3.84
90% KM Chebyshev UCL	1.802	95% KM Chebyshev UCL	2.308
97.5% KM Chebyshev UCL	3.01	99% KM Chebyshev UCL	4.39

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.332	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.764	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.314	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.265	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.736	k star (bias corrected MLE)	0.596
Theta hat (MLE)	1.07	Theta star (bias corrected MLE)	1.321
nu hat (MLE)	16.18	nu star (bias corrected)	13.1
Mean (detects)	0.787		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.631
Maximum	5	Median	0.168
SD	1.296	CV	2.054
k hat (MLE)	0.541	k star (bias corrected MLE)	0.473
Theta hat (MLE)	1.165	Theta star (bias corrected MLE)	1.334
nu hat (MLE)	15.16	nu star (bias corrected)	13.24
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (13.24, α)	6.057	Adjusted Chi Square Value (13.24, β)	5.425
95% Gamma Approximate UCL (use when n>=50)	1.379	95% Gamma Adjusted UCL (use when n<50)	1.54

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.684	SD (KM)	1.281
Variance (KM)	1.64	SE of Mean (KM)	0.372
k hat (KM)	0.286	k star (KM)	0.272
nu hat (KM)	7.995	nu star (KM)	7.615
theta hat (KM)	2.396	theta star (KM)	2.516
80% gamma percentile (KM)	1.022	90% gamma percentile (KM)	2.039
95% gamma percentile (KM)	3.228	99% gamma percentile (KM)	6.357

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.61, α)	2.514	Adjusted Chi Square Value (7.61, β)	2.142
95% Gamma Approximate KM-UCL (use when n>=50)	2.072	95% Gamma Adjusted KM-UCL (use when n<50)	2.432

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.807	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.639	Mean in Log Scale	-1.452
SD in Original Scale	1.292	SD in Log Scale	1.377
95% t UCL (assumes normality of ROS data)	1.251	95% Percentile Bootstrap UCL	1.287
95% BCA Bootstrap UCL	1.676	95% Bootstrap t UCL	3.271
95% H-UCL (Log ROS)	2.263		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.219	KM Geo Mean	0.295
KM SD (logged)	1.084	95% Critical H Value (KM-Log)	2.933
KM Standard Error of Mean (logged)	0.315	95% H-UCL (KM -Log)	1.284
KM SD (logged)	1.084	95% Critical H Value (KM-Log)	2.933
KM Standard Error of Mean (logged)	0.315		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.856	Mean in Log Scale	-1.143
SD in Original Scale	1.451	SD in Log Scale	1.361
95% t UCL (Assumes normality)	1.542	95% H-Stat UCL	2.938

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	2.308

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	3
Minimum	1.8	Mean	7.261
Maximum	17.7	Median	7.25
SD	3.649	Std. Error of Mean	0.975
Coefficient of Variation	0.502	Skewness	1.652

Normal GOF Test

Shapiro Wilk Test Statistic	0.827	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8.988	95% Adjusted-CLT UCL (Chen-1995)	9.325
		95% Modified-t UCL (Johnson-1978)	9.059

Gamma GOF Test

A-D Test Statistic	0.729	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.23	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.395	k star (bias corrected MLE)	3.501
Theta hat (MLE)	1.652	Theta star (bias corrected MLE)	2.074
nu hat (MLE)	123.1	nu star (bias corrected)	98.02
MLE Mean (bias corrected)	7.261	MLE Sd (bias corrected)	3.881
		Approximate Chi Square Value (0.05)	76.18
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	73.63

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	9.342	95% Adjusted Gamma UCL (use when n<50)	9.666

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.265	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.588	Mean of logged Data	1.864
Maximum of Logged Data	2.874	SD of logged Data	0.532

Assuming Lognormal Distribution

95% H-UCL	10.07	90% Chebyshev (MVUE) UCL	10.59
95% Chebyshev (MVUE) UCL	12.05	97.5% Chebyshev (MVUE) UCL	14.09
99% Chebyshev (MVUE) UCL	18.08		

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8.865	95% Jackknife UCL	8.988
95% Standard Bootstrap UCL	8.785	95% Bootstrap-t UCL	9.589
95% Hall's Bootstrap UCL	17.84	95% Percentile Bootstrap UCL	8.893
95% BCA Bootstrap UCL	9.421		
90% Chebyshev(Mean, Sd) UCL	10.19	95% Chebyshev(Mean, Sd) UCL	11.51
97.5% Chebyshev(Mean, Sd) UCL	13.35	99% Chebyshev(Mean, Sd) UCL	16.96

Suggested UCL to Use

95% Student's-t UCL	8.988

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	2
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	0.091	Minimum Non-Detect	0.68
Maximum Detect	15	Maximum Non-Detect	0.68
Variance Detects	16.77	Percent Non-Detects	7.143%
Mean Detects	1.378	SD Detects	4.095
Median Detects	0.23	CV Detects	2.972
Skewness Detects	3.598	Kurtosis Detects	12.96
Mean of Logged Detects	-1.211	SD of Logged Detects	1.272

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.335	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.492	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.297	KM Standard Error of Mean	1.058
KM SD	3.803	95% KM (BCA) UCL	3.421
95% KM (t) UCL	3.171	95% KM (Percentile Bootstrap) UCL	3.38
95% KM (z) UCL	3.037	95% KM Bootstrap t UCL	76.68
90% KM Chebyshev UCL	4.471	95% KM Chebyshev UCL	5.908
97.5% KM Chebyshev UCL	7.904	99% KM Chebyshev UCL	11.82

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.244	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.805	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.469	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.252	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.425	k star (bias corrected MLE)	0.378
Theta hat (MLE)	3.24	Theta star (bias corrected MLE)	3.641
nu hat (MLE)	11.06	nu star (bias corrected)	9.841
Mean (detects)	1.378		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.28
Maximum	15	Median	0.225
SD	3.952	CV	3.086
k hat (MLE)	0.389	k star (bias corrected MLE)	0.353
Theta hat (MLE)	3.294	Theta star (bias corrected MLE)	3.627
nu hat (MLE)	10.88	nu star (bias corrected)	9.885
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (9.89, α)	3.87	Adjusted Chi Square Value (9.89, β)	3.386
95% Gamma Approximate UCL (use when n>=50)	3.27	95% Gamma Adjusted UCL (use when n<50)	3.739

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.297	SD (KM)	3.803
Variance (KM)	14.46	SE of Mean (KM)	1.058
k hat (KM)	0.116	k star (KM)	0.139
nu hat (KM)	3.257	nu star (KM)	3.893
theta hat (KM)	11.15	theta star (KM)	9.33
80% gamma percentile (KM)	1.322	90% gamma percentile (KM)	3.8
95% gamma percentile (KM)	7.239	99% gamma percentile (KM)	17.38

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.89, α)	0.68	Adjusted Chi Square Value (3.89, β)	0.527
95% Gamma Approximate KM-UCL (use when n>=50)	7.428	95% Gamma Adjusted KM-UCL (use when n<50)	9.579

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.638	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.389	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.298	Mean in Log Scale	-1.22
SD in Original Scale	3.946	SD in Log Scale	1.222
95% t UCL (assumes normality of ROS data)	3.166	95% Percentile Bootstrap UCL	3.397
95% BCA Bootstrap UCL	4.474	95% Bootstrap t UCL	80.93
95% H-UCL (Log ROS)	1.827		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.234	KM Geo Mean	0.291
KM SD (logged)	1.187	95% Critical H Value (KM-Log)	3.113
KM Standard Error of Mean (logged)	0.332	95% H-UCL (KM -Log)	1.641
KM SD (logged)	1.187	95% Critical H Value (KM-Log)	3.113
KM Standard Error of Mean (logged)	0.332		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.304	Mean in Log Scale	-1.202
SD in Original Scale	3.944	SD in Log Scale	1.222
95% t UCL (Assumes normality)	3.171	95% H-Stat UCL	1.862

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	5.908

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	6	Number of Non-Detects	8
Number of Distinct Detects	5	Number of Distinct Non-Detects	5
Minimum Detect	0.31	Minimum Non-Detect	0.25
Maximum Detect	1.7	Maximum Non-Detect	1.4
Variance Detects	0.222	Percent Non-Detects	57.14%
Mean Detects	0.863	SD Detects	0.471
Median Detects	0.755	CV Detects	0.545
Skewness Detects	1.156	Kurtosis Detects	2.129
Mean of Logged Detects	-0.272	SD of Logged Detects	0.562

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.526	KM Standard Error of Mean	0.123
KM SD	0.414	95% KM (BCA) UCL	0.734
95% KM (t) UCL	0.744	95% KM (Percentile Bootstrap) UCL	0.721
95% KM (z) UCL	0.729	95% KM Bootstrap t UCL	0.764
90% KM Chebyshev UCL	0.896	95% KM Chebyshev UCL	1.063
97.5% KM Chebyshev UCL	1.296	99% KM Chebyshev UCL	1.752

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.255	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.147	k star (bias corrected MLE)	2.184
Theta hat (MLE)	0.208	Theta star (bias corrected MLE)	0.395
nu hat (MLE)	49.76	nu star (bias corrected)	26.21
Mean (detects)	0.863		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.398
Maximum	1.7	Median	0.148
SD	0.513	CV	1.29
k hat (MLE)	0.475	k star (bias corrected MLE)	0.421
Theta hat (MLE)	0.837	Theta star (bias corrected MLE)	0.944
nu hat (MLE)	13.3	nu star (bias corrected)	11.79
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (11.79, α)	5.087	Adjusted Chi Square Value (11.79, β)	4.516
95% Gamma Approximate UCL (use when n>=50)	0.921	95% Gamma Adjusted UCL (use when n<50)	1.038

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.526	SD (KM)	0.414
Variance (KM)	0.172	SE of Mean (KM)	0.123
k hat (KM)	1.613	k star (KM)	1.315
nu hat (KM)	45.17	nu star (KM)	36.82
theta hat (KM)	0.326	theta star (KM)	0.4
80% gamma percentile (KM)	0.826	90% gamma percentile (KM)	1.132
95% gamma percentile (KM)	1.433	99% gamma percentile (KM)	2.118

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (36.82, α)	23.93	Adjusted Chi Square Value (36.82, β)	22.56
95% Gamma Approximate KM-UCL (use when n>=50)	0.81	95% Gamma Adjusted KM-UCL (use when n<50)	0.859

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.489	Mean in Log Scale	-1.038
SD in Original Scale	0.448	SD in Log Scale	0.806
95% t UCL (assumes normality of ROS data)	0.701	95% Percentile Bootstrap UCL	0.692
95% BCA Bootstrap UCL	0.753	95% Bootstrap t UCL	0.855
95% H-UCL (Log ROS)	0.855		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.881	KM Geo Mean	0.415
KM SD (logged)	0.649	95% Critical H Value (KM-Log)	2.278
KM Standard Error of Mean (logged)	0.195	95% H-UCL (KM -Log)	0.771
KM SD (logged)	0.649	95% Critical H Value (KM-Log)	2.278
KM Standard Error of Mean (logged)	0.195		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.488	Mean in Log Scale	-1.144
SD in Original Scale	0.47	SD in Log Scale	0.96
95% t UCL (Assumes normality)	0.71	95% H-Stat UCL	1.042

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.744

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	3
Minimum	1.2	Mean	4.457
Maximum	7.9	Median	4.55
SD	1.699	Std. Error of Mean	0.454
Coefficient of Variation	0.381	Skewness	-0.00417

Normal GOF Test

Shapiro Wilk Test Statistic	0.979	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.153	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.261	95% Adjusted-CLT UCL (Chen-1995)	5.203
		95% Modified-t UCL (Johnson-1978)	5.261

Gamma GOF Test

A-D Test Statistic	0.402	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.229	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.93	k star (bias corrected MLE)	4.707
Theta hat (MLE)	0.752	Theta star (bias corrected MLE)	0.947
nu hat (MLE)	166	nu star (bias corrected)	131.8
MLE Mean (bias corrected)	4.457	MLE Sd (bias corrected)	2.054
		Approximate Chi Square Value (0.05)	106.3
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	103.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	5.527	95% Adjusted Gamma UCL (use when n<50)	5.69

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.182	Mean of logged Data	1.408
Maximum of Logged Data	2.067	SD of logged Data	0.471

Assuming Lognormal Distribution

95% H-UCL	5.937	90% Chebyshev (MVUE) UCL	6.281
95% Chebyshev (MVUE) UCL	7.075	97.5% Chebyshev (MVUE) UCL	8.177
99% Chebyshev (MVUE) UCL	10.34		

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.204	95% Jackknife UCL	5.261
95% Standard Bootstrap UCL	5.174	95% Bootstrap-t UCL	5.214
95% Hall's Bootstrap UCL	5.299	95% Percentile Bootstrap UCL	5.15
95% BCA Bootstrap UCL	5.114		
90% Chebyshev(Mean, Sd) UCL	5.819	95% Chebyshev(Mean, Sd) UCL	6.436
97.5% Chebyshev(Mean, Sd) UCL	7.292	99% Chebyshev(Mean, Sd) UCL	8.974

Suggested UCL to Use

95% Student's-t UCL	5.261

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	3
Minimum	6040	Mean	15502
Maximum	54000	Median	13500
SD	11821	Std. Error of Mean	3159
Coefficient of Variation	0.763	Skewness	2.994

Normal GOF Test

Shapiro Wilk Test Statistic	0.623	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.34	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	21097	95% Adjusted-CLT UCL (Chen-1995)	23400
		95% Modified-t UCL (Johnson-1978)	21518

Gamma GOF Test

A-D Test Statistic	0.938	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.742	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.261	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.23	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.252	k star (bias corrected MLE)	2.603
Theta hat (MLE)	4766	Theta star (bias corrected MLE)	5955
nu hat (MLE)	91.07	nu star (bias corrected)	72.89
MLE Mean (bias corrected)	15502	MLE Sd (bias corrected)	9608
		Approximate Chi Square Value (0.05)	54.23
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	52.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	20836	95% Adjusted Gamma UCL (use when n<50)	21689

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.706	Mean of logged Data	9.487
Maximum of Logged Data	10.9	SD of logged Data	0.536

Assuming Lognormal Distribution

95% H-UCL	20689	90% Chebyshev (MVUE) UCL	21737
95% Chebyshev (MVUE) UCL	24763	97.5% Chebyshev (MVUE) UCL	28963
99% Chebyshev (MVUE) UCL	37213		

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	20699	95% Jackknife UCL	21097
95% Standard Bootstrap UCL	20409	95% Bootstrap-t UCL	29237
95% Hall's Bootstrap UCL	44955	95% Percentile Bootstrap UCL	21131
95% BCA Bootstrap UCL	24429		
90% Chebyshev(Mean, Sd) UCL	24980	95% Chebyshev(Mean, Sd) UCL	29273
97.5% Chebyshev(Mean, Sd) UCL	35232	99% Chebyshev(Mean, Sd) UCL	46937

Suggested UCL to Use

95% H-UCL 20689

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	14	Number of Distinct Observations	11
		Number of Missing Observations	3
Minimum	6.4	Mean	131.7
Maximum	1000	Median	24.5
SD	287	Std. Error of Mean	76.71
Coefficient of Variation	2.18	Skewness	2.702

Normal GOF Test

Shapiro Wilk Test Statistic	0.494	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.445	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	267.5	95% Adjusted-CLT UCL (Chen-1995)	317
		95% Modified-t UCL (Johnson-1978)	276.8

Gamma GOF Test

A-D Test Statistic	1.817	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.803	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.311	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.243	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.45	k star (bias corrected MLE)	0.401
Theta hat (MLE)	292.5	Theta star (bias corrected MLE)	328.1
nu hat (MLE)	12.61	nu star (bias corrected)	11.24
MLE Mean (bias corrected)	131.7	MLE Sd (bias corrected)	207.8
		Approximate Chi Square Value (0.05)	4.729
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	4.183

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	312.9	95% Adjusted Gamma UCL (use when n<50)	353.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.856	Mean of logged Data	3.446
Maximum of Logged Data	6.908	SD of logged Data	1.528

Assuming Lognormal Distribution

95% H-UCL	493.1	90% Chebyshev (MVUE) UCL	206.6
95% Chebyshev (MVUE) UCL	261	97.5% Chebyshev (MVUE) UCL	336.4
99% Chebyshev (MVUE) UCL	484.5		

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	257.8	95% Jackknife UCL	267.5
95% Standard Bootstrap UCL	252.2	95% Bootstrap-t UCL	1909
95% Hall's Bootstrap UCL	1044	95% Percentile Bootstrap UCL	267.6
95% BCA Bootstrap UCL	317.4		
90% Chebyshev(Mean, Sd) UCL	361.8	95% Chebyshev(Mean, Sd) UCL	466
97.5% Chebyshev(Mean, Sd) UCL	610.7	99% Chebyshev(Mean, Sd) UCL	894.9

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	894.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	3
Minimum	84.9	Mean	798
Maximum	6000	Median	390
SD	1504	Std. Error of Mean	401.9
Coefficient of Variation	1.885	Skewness	3.684

Normal GOF Test

Shapiro Wilk Test Statistic	0.383	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.457	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1510	95% Adjusted-CLT UCL (Chen-1995)	1882
		95% Modified-t UCL (Johnson-1978)	1576

Gamma GOF Test

A-D Test Statistic	2.427	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.761	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.349	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.235	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.987	k star (bias corrected MLE)	0.823
Theta hat (MLE)	808.6	Theta star (bias corrected MLE)	969.6
nu hat (MLE)	27.63	nu star (bias corrected)	23.04
MLE Mean (bias corrected)	798	MLE Sd (bias corrected)	879.6
		Approximate Chi Square Value (0.05)	13.12
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	12.14

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1401	95% Adjusted Gamma UCL (use when n<50)	1515

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.76	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.441	Mean of logged Data	6.096
Maximum of Logged Data	8.7	SD of logged Data	0.892

Assuming Lognormal Distribution

95% H-UCL	1263	90% Chebyshev (MVUE) UCL	1126
95% Chebyshev (MVUE) UCL	1347	97.5% Chebyshev (MVUE) UCL	1655
99% Chebyshev (MVUE) UCL	2258		

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	1459	95% Jackknife UCL	1510
95% Standard Bootstrap UCL	1442	95% Bootstrap-t UCL	6546
95% Hall's Bootstrap UCL	5523	95% Percentile Bootstrap UCL	1594
95% BCA Bootstrap UCL	2000		
90% Chebyshev(Mean, Sd) UCL	2004	95% Chebyshev(Mean, Sd) UCL	2550
97.5% Chebyshev(Mean, Sd) UCL	3308	99% Chebyshev(Mean, Sd) UCL	4797

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	2550

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	14	Number of Distinct Observations	11
		Number of Missing Observations	3
Number of Detects	12	Number of Non-Detects	2
Number of Distinct Detects	10	Number of Distinct Non-Detects	2
Minimum Detect	0.083	Minimum Non-Detect	0.046
Maximum Detect	0.54	Maximum Non-Detect	0.11
Variance Detects	0.0147	Percent Non-Detects	14.29%
Mean Detects	0.184	SD Detects	0.121
Median Detects	0.155	CV Detects	0.657
Skewness Detects	2.621	Kurtosis Detects	7.793
Mean of Logged Detects	-1.821	SD of Logged Detects	0.49

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.688	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.167	KM Standard Error of Mean	0.0325
KM SD	0.116	95% KM (BCA) UCL	0.226
95% KM (t) UCL	0.224	95% KM (Percentile Bootstrap) UCL	0.224
95% KM (z) UCL	0.22	95% KM Bootstrap t UCL	0.276
90% KM Chebyshev UCL	0.264	95% KM Chebyshev UCL	0.308
97.5% KM Chebyshev UCL	0.37	99% KM Chebyshev UCL	0.49

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.686	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.21	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.994	k star (bias corrected MLE)	3.051
Theta hat (MLE)	0.0462	Theta star (bias corrected MLE)	0.0604
nu hat (MLE)	95.87	nu star (bias corrected)	73.23
Mean (detects)	0.184		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.161
Maximum	0.54	Median	0.15
SD	0.126	CV	0.784
k hat (MLE)	1.772	k star (bias corrected MLE)	1.44
Theta hat (MLE)	0.0909	Theta star (bias corrected MLE)	0.112
nu hat (MLE)	49.62	nu star (bias corrected)	40.32
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (40.32, α)	26.77	Adjusted Chi Square Value (40.32, β)	25.31
95% Gamma Approximate UCL (use when n>=50)	0.243	95% Gamma Adjusted UCL (use when n<50)	0.257

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.167	SD (KM)	0.116
Variance (KM)	0.0135	SE of Mean (KM)	0.0325
k hat (KM)	2.065	k star (KM)	1.67
nu hat (KM)	57.81	nu star (KM)	46.75
theta hat (KM)	0.0808	theta star (KM)	0.0999
80% gamma percentile (KM)	0.255	90% gamma percentile (KM)	0.339
95% gamma percentile (KM)	0.419	99% gamma percentile (KM)	0.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (46.75, α)	32.06	Adjusted Chi Square Value (46.75, β)	30.46
95% Gamma Approximate KM-UCL (use when n>=50)	0.243	95% Gamma Adjusted KM-UCL (use when n<50)	0.256

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.167	Mean in Log Scale	-1.96
SD in Original Scale	0.12	SD in Log Scale	0.577
95% t UCL (assumes normality of ROS data)	0.224	95% Percentile Bootstrap UCL	0.225
95% BCA Bootstrap UCL	0.25	95% Bootstrap t UCL	0.278
95% H-UCL (Log ROS)	0.235		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.968	KM Geo Mean	0.14
KM SD (logged)	0.578	95% Critical H Value (KM-Log)	2.147
KM Standard Error of Mean (logged)	0.164	95% H-UCL (KM -Log)	0.233
KM SD (logged)	0.578	95% Critical H Value (KM-Log)	2.147
KM Standard Error of Mean (logged)	0.164		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.164	Mean in Log Scale	-2.037
SD in Original Scale	0.124	SD in Log Scale	0.732
95% t UCL (Assumes normality)	0.222	95% H-Stat UCL	0.276

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.256	95% GROS Adjusted Gamma UCL	0.257

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	3
Minimum	5.2	Mean	27.58
Maximum	170	Median	18.5
SD	41.51	Std. Error of Mean	11.09
Coefficient of Variation	1.505	Skewness	3.581

Normal GOF Test

Shapiro Wilk Test Statistic	0.445	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.423	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	47.22	95% Adjusted-CLT UCL (Chen-1995)	57.17
		95% Modified-t UCL (Johnson-1978)	48.99

Gamma GOF Test

A-D Test Statistic	1.583	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.755	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.326	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.234	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.29	k star (bias corrected MLE)	1.061
Theta hat (MLE)	21.38	Theta star (bias corrected MLE)	25.99
nu hat (MLE)	36.12	nu star (bias corrected)	29.71
MLE Mean (bias corrected)	27.58	MLE Sd (bias corrected)	26.77
		Approximate Chi Square Value (0.05)	18.27
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	17.08

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	44.86	95% Adjusted Gamma UCL (use when n<50)	47.97

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.649	Mean of logged Data	2.882
Maximum of Logged Data	5.136	SD of logged Data	0.814

Assuming Lognormal Distribution

95% H-UCL	43.72	90% Chebyshev (MVUE) UCL	40.89
95% Chebyshev (MVUE) UCL	48.49	97.5% Chebyshev (MVUE) UCL	59.02
99% Chebyshev (MVUE) UCL	79.72		

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	45.82	95% Jackknife UCL	47.22
95% Standard Bootstrap UCL	45.4	95% Bootstrap-t UCL	115.6
95% Hall's Bootstrap UCL	139.1	95% Percentile Bootstrap UCL	49.27
95% BCA Bootstrap UCL	61.62		
90% Chebyshev(Mean, Sd) UCL	60.86	95% Chebyshev(Mean, Sd) UCL	75.93
97.5% Chebyshev(Mean, Sd) UCL	96.85	99% Chebyshev(Mean, Sd) UCL	137.9

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	75.93

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	9
		Number of Missing Observations	2
Number of Detects	1	Number of Non-Detects	13
Number of Distinct Detects	1	Number of Distinct Non-Detects	8

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1242 (PCB-1242) was not processed!

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	9
		Number of Missing Observations	2
Number of Detects	2	Number of Non-Detects	12
Number of Distinct Detects	2	Number of Distinct Non-Detects	7
Minimum Detect	70	Minimum Non-Detect	24
Maximum Detect	1300	Maximum Non-Detect	45
Variance Detects	756450	Percent Non-Detects	85.71%
Mean Detects	685	SD Detects	869.7
Median Detects	685	CV Detects	1.27
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	5.709	SD of Logged Detects	2.066

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	118.4	KM Standard Error of Mean	123.9
KM SD	327.9	95% KM (BCA) UCL	N/A
95% KM (t) UCL	337.9	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	322.3	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	490.3	95% KM Chebyshev UCL	658.7
97.5% KM Chebyshev UCL	892.5	99% KM Chebyshev UCL	1352

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.732	k star (bias corrected MLE)	N/A
Theta hat (MLE)	935.4	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	2.929	nu star (bias corrected)	N/A
Mean (detects)	685		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	118.4	SD (KM)	327.9
Variance (KM)	107533	SE of Mean (KM)	123.9
k hat (KM)	0.13	k star (KM)	0.15
nu hat (KM)	3.652	nu star (KM)	4.203
theta hat (KM)	908	theta star (KM)	789
80% gamma percentile (KM)	129	90% gamma percentile (KM)	351.2
95% gamma percentile (KM)	651.7	99% gamma percentile (KM)	1524

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0312
Approximate Chi Square Value (4.20, α)	0.803	Adjusted Chi Square Value (4.20, β)	0.631
95% Gamma Approximate KM-UCL (use when n>=50)	619.5	95% Gamma Adjusted KM-UCL (use when n<50)	789.3

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	97.86	Mean in Log Scale	-6.016
SD in Original Scale	346.5	SD in Log Scale	5.766
95% t UCL (assumes normality of ROS data)	261.9	95% Percentile Bootstrap UCL	278.6
95% BCA Bootstrap UCL	391.4	95% Bootstrap t UCL	2899820
95% H-UCL (Log ROS)	2.515E+13		

Table B.3.4

Summary of ProUCL Output for EU03 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 10:49:39 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.54	KM Geo Mean	34.46
KM SD (logged)	1.044	95% Critical H Value (KM-Log)	2.865
KM Standard Error of Mean (logged)	0.395	95% H-UCL (KM -Log)	136.1
KM SD (logged)	1.044	95% Critical H Value (KM-Log)	2.865
KM Standard Error of Mean (logged)	0.395		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	109.9	Mean in Log Scale	3.064
SD in Original Scale	342.9	SD in Log Scale	1.271
95% t UCL (Assumes normality)	272.2	95% H-Stat UCL	151.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

KM Bootstrap t UCL	N/A

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.1

Summary of ProUCL Input Data for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Aluminum	D_Aluminum	Antimony	D_Antimony
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	17.85	1	26.5	1	31	0	1.1	0	14000	1	0.74	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	55	1	94	1	21	0	12	1	4800	1	0.23	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	12	1	20	1	26	0	0.92	0	7500	1	12	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	690	1	1000	1	87	0	130	1	7100	1	0.56	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	11	1	14	1	22	0	0.76	0	8300	1	0.16	1
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	1100	1	1300	1	130	1	180	1	6000	1	0.36	1

Table B.4.1

Summary of ProUCL Input Data for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23	24	25
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	32	1	1.2	1	14	1	14000	1	180	1	1.125	1	58.5	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	7.4	1	0.51	1	5.2	1	11000	1	320	1	0.13	1	15	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	50	1	0.54	1	27	1	12000	1	280	1	0.96	1	38	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	7.3	1	0.28	0	5.6	1	14000	1	370	1	0.18	1	19	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	10	1	0.28	0	6.9	1	18000	1	410	1	0.3	1	20	1
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	8.9	1	0.66	1	5.3	1	15000	1	410	1	0.21	1	17	1

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	11	Mean	314.3
Maximum	1100	Median	36.43
SD	468.4	Std. Error of Mean	191.2
Coefficient of Variation	1.49	Skewness	1.282

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.728	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.377	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	699.6	95% Adjusted-CLT UCL (Chen-1995)	735.7
		95% Modified-t UCL (Johnson-1978)	716.3

Gamma GOF Test

A-D Test Statistic	0.67	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.301	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.352	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.425	k star (bias corrected MLE)	0.324
Theta hat (MLE)	738.9	Theta star (bias corrected MLE)	970.7
nu hat (MLE)	5.105	nu star (bias corrected)	3.886
MLE Mean (bias corrected)	314.3	MLE Sd (bias corrected)	552.4
		Approximate Chi Square Value (0.05)	0.677
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.326

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1804	95% Adjusted Gamma UCL (use when n<50)	3744

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.398	Mean of logged Data	4.219
Maximum of Logged Data	7.003	SD of logged Data	2.063

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	859837	90% Chebyshev (MVUE) UCL	943.1
95% Chebyshev (MVUE) UCL	1236	97.5% Chebyshev (MVUE) UCL	1643
99% Chebyshev (MVUE) UCL	2443		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	628.8	95% Jackknife UCL	699.6
95% Standard Bootstrap UCL	610.5	95% Bootstrap-t UCL	6692
95% Hall's Bootstrap UCL	5265	95% Percentile Bootstrap UCL	615
95% BCA Bootstrap UCL	676		
90% Chebyshev(Mean, Sd) UCL	888	95% Chebyshev(Mean, Sd) UCL	1148
97.5% Chebyshev(Mean, Sd) UCL	1508	99% Chebyshev(Mean, Sd) UCL	2217

Suggested UCL to Use

95% Adjusted Gamma UCL	3744

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	14	Mean	409.1
Maximum	1300	Median	60.25
SD	582.4	Std. Error of Mean	237.8
Coefficient of Variation	1.424	Skewness	1.072

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.724	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.372	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	888.2	95% Adjusted-CLT UCL (Chen-1995)	911.3
		95% Modified-t UCL (Johnson-1978)	905.5

Gamma GOF Test

A-D Test Statistic	0.645	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.351	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.453	k star (bias corrected MLE)	0.337
Theta hat (MLE)	903.6	Theta star (bias corrected MLE)	1212
nu hat (MLE)	5.433	nu star (bias corrected)	4.05
MLE Mean (bias corrected)	409.1	MLE Sd (bias corrected)	704.2
		Approximate Chi Square Value (0.05)	0.741
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.363

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2234	95% Adjusted Gamma UCL (use when n<50)	4559

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.639	Mean of logged Data	4.589
Maximum of Logged Data	7.17	SD of logged Data	2.005

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	745356	90% Chebyshev (MVUE) UCL	1257
95% Chebyshev (MVUE) UCL	1646	97.5% Chebyshev (MVUE) UCL	2185
99% Chebyshev (MVUE) UCL	3245		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	800.2	95% Jackknife UCL	888.2
95% Standard Bootstrap UCL	767.2	95% Bootstrap-t UCL	7361
95% Hall's Bootstrap UCL	5764	95% Percentile Bootstrap UCL	784.7
95% BCA Bootstrap UCL	824.4		
90% Chebyshev(Mean, Sd) UCL	1122	95% Chebyshev(Mean, Sd) UCL	1445
97.5% Chebyshev(Mean, Sd) UCL	1894	99% Chebyshev(Mean, Sd) UCL	2775

Suggested UCL to Use

95% Adjusted Gamma UCL	4559

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	1	Number of Non-Detects	5
Number of Distinct Detects	1	Number of Distinct Non-Detects	5

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Carbazole was not processed!

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
Number of Detects	3	Number of Non-Detects	3
Number of Distinct Detects	3	Number of Distinct Non-Detects	3
Minimum Detect	12	Minimum Non-Detect	0.76
Maximum Detect	180	Maximum Non-Detect	1.1
Variance Detects	7441	Percent Non-Detects	50%
Mean Detects	107.3	SD Detects	86.26
Median Detects	130	CV Detects	0.804
Skewness Detects	-1.101	Kurtosis Detects	N/A
Mean of Logged Detects	4.182	SD of Logged Detects	1.479

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	54.05	KM Standard Error of Mean	36.47
KM SD	72.94	95% KM (BCA) UCL	N/A
95% KM (t) UCL	127.5	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	114	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	163.5	95% KM Chebyshev UCL	213
97.5% KM Chebyshev UCL	281.8	99% KM Chebyshev UCL	416.9

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.15	k star (bias corrected MLE)	N/A
Theta hat (MLE)	93.34	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	6.899	nu star (bias corrected)	N/A
Mean (detects)	107.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	53.67
Maximum	180	Median	6.005
SD	80.2	CV	1.494
k hat (MLE)	0.179	k star (bias corrected MLE)	0.2
Theta hat (MLE)	300.6	Theta star (bias corrected MLE)	267.8
nu hat (MLE)	2.143	nu star (bias corrected)	2.405
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (2.40, α)	0.22	Adjusted Chi Square Value (2.40, β)	0.106
95% Gamma Approximate UCL (use when n>=50)	585.7	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	54.05	SD (KM)	72.94
Variance (KM)	5320	SE of Mean (KM)	36.47
k hat (KM)	0.549	k star (KM)	0.386
nu hat (KM)	6.589	nu star (KM)	4.628
theta hat (KM)	98.43	theta star (KM)	140.1
80% gamma percentile (KM)	86.83	90% gamma percentile (KM)	153.6
95% gamma percentile (KM)	227.4	99% gamma percentile (KM)	413.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.63, α)	0.984	Adjusted Chi Square Value (4.63, β)	0.511
95% Gamma Approximate KM-UCL (use when n>=50)	254.1	95% Gamma Adjusted KM-UCL (use when n<50)	489.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.345	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	54.1	Mean in Log Scale	2.018
SD in Original Scale	79.86	SD in Log Scale	2.548
95% t UCL (assumes normality of ROS data)	119.8	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	12529884		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.954	KM Geo Mean	7.055
KM SD (logged)	2.386	95% Critical H Value (KM-Log)	9.124
KM Standard Error of Mean (logged)	1.193	95% H-UCL (KM -Log)	2055331
KM SD (logged)	2.386	95% Critical H Value (KM-Log)	9.124
KM Standard Error of Mean (logged)	1.193		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	53.9	Mean in Log Scale	1.701
SD in Original Scale	80.02	SD in Log Scale	2.877
95% t UCL (Assumes normality)	119.7	95% H-Stat UCL	4.461E+8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	127.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	4800	Mean	7950
Maximum	14000	Median	7300
SD	3205	Std. Error of Mean	1309
Coefficient of Variation	0.403	Skewness	1.659

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.847	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.29	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	10587	95% Adjusted-CLT UCL (Chen-1995)	11049
		95% Modified-t UCL (Johnson-1978)	10735

Gamma GOF Test

A-D Test Statistic	0.356	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.775	k star (bias corrected MLE)	4.499
Theta hat (MLE)	905.9	Theta star (bias corrected MLE)	1767
nu hat (MLE)	105.3	nu star (bias corrected)	53.99
MLE Mean (bias corrected)	7950	MLE Sd (bias corrected)	3748
		Approximate Chi Square Value (0.05)	38.1
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	33.35

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	11263	95% Adjusted Gamma UCL (use when n<50)	12869

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.223	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.476	Mean of logged Data	8.923
Maximum of Logged Data	9.547	SD of logged Data	0.361

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	11678	90% Chebyshev (MVUE) UCL	11417
95% Chebyshev (MVUE) UCL	13002	97.5% Chebyshev (MVUE) UCL	15202
99% Chebyshev (MVUE) UCL	19524		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	10102	95% Jackknife UCL	10587
95% Standard Bootstrap UCL	9954	95% Bootstrap-t UCL	12832
95% Hall's Bootstrap UCL	21059	95% Percentile Bootstrap UCL	10183
95% BCA Bootstrap UCL	10750		
90% Chebyshev(Mean, Sd) UCL	11876	95% Chebyshev(Mean, Sd) UCL	13654
97.5% Chebyshev(Mean, Sd) UCL	16122	99% Chebyshev(Mean, Sd) UCL	20971

Suggested UCL to Use

95% Student's-t UCL	10587

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.16	Mean	2.342
Maximum	12	Median	0.46
SD	4.736	Std. Error of Mean	1.934
Coefficient of Variation	2.023	Skewness	2.438

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.539	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.466	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.238	95% Adjusted-CLT UCL (Chen-1995)	7.579
		95% Modified-t UCL (Johnson-1978)	6.559

Gamma GOF Test

A-D Test Statistic	0.963	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.738	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.402	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.349	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.489	k star (bias corrected MLE)	0.355
Theta hat (MLE)	4.791	Theta star (bias corrected MLE)	6.587
nu hat (MLE)	5.865	nu star (bias corrected)	4.266
MLE Mean (bias corrected)	2.342	MLE Sd (bias corrected)	3.927
		Approximate Chi Square Value (0.05)	0.829
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.416

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	12.04	95% Adjusted Gamma UCL (use when n<50)	24.03

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.294	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.833	Mean of logged Data	-0.453
Maximum of Logged Data	2.485	SD of logged Data	1.545

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	136	90% Chebyshev (MVUE) UCL	4.262
95% Chebyshev (MVUE) UCL	5.497	97.5% Chebyshev (MVUE) UCL	7.209
99% Chebyshev (MVUE) UCL	10.57		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.522	95% Jackknife UCL	6.238
95% Standard Bootstrap UCL	5.255	95% Bootstrap-t UCL	64.73
95% Hall's Bootstrap UCL	42.93	95% Percentile Bootstrap UCL	6.103
95% BCA Bootstrap UCL	6.34		
90% Chebyshev(Mean, Sd) UCL	8.143	95% Chebyshev(Mean, Sd) UCL	10.77
97.5% Chebyshev(Mean, Sd) UCL	14.42	99% Chebyshev(Mean, Sd) UCL	21.58

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	21.58

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	7.3	Mean	19.27
Maximum	50	Median	9.45
SD	17.8	Std. Error of Mean	7.266
Coefficient of Variation	0.924	Skewness	1.373

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.365	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	33.91	95% Adjusted-CLT UCL (Chen-1995)	35.57
		95% Modified-t UCL (Johnson-1978)	34.59

Gamma GOF Test

A-D Test Statistic	0.753	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.706	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.362	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.337	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.731	k star (bias corrected MLE)	0.977
Theta hat (MLE)	11.13	Theta star (bias corrected MLE)	19.72
nu hat (MLE)	20.78	nu star (bias corrected)	11.72
MLE Mean (bias corrected)	19.27	MLE Sd (bias corrected)	19.49
		Approximate Chi Square Value (0.05)	5.045
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	3.586

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	44.77	95% Adjusted Gamma UCL (use when n<50)	62.97

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.797	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.325	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.988	Mean of logged Data	2.643
Maximum of Logged Data	3.912	SD of logged Data	0.831

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	74.75	90% Chebyshev (MVUE) UCL	37.22
95% Chebyshev (MVUE) UCL	45.69	97.5% Chebyshev (MVUE) UCL	57.45
99% Chebyshev (MVUE) UCL	80.53		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	31.22	95% Jackknife UCL	33.91
95% Standard Bootstrap UCL	29.91	95% Bootstrap-t UCL	187.2
95% Hall's Bootstrap UCL	139.3	95% Percentile Bootstrap UCL	30.48
95% BCA Bootstrap UCL	33.23		
90% Chebyshev(Mean, Sd) UCL	41.07	95% Chebyshev(Mean, Sd) UCL	50.94
97.5% Chebyshev(Mean, Sd) UCL	64.65	99% Chebyshev(Mean, Sd) UCL	91.57

Suggested UCL to Use

95% H-UCL	74.75

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	1
Minimum Detect	0.51	Minimum Non-Detect	0.28
Maximum Detect	1.2	Maximum Non-Detect	0.28
Variance Detects	0.103	Percent Non-Detects	33.33%
Mean Detects	0.728	SD Detects	0.322
Median Detects	0.6	CV Detects	0.442
Skewness Detects	1.77	Kurtosis Detects	3.121
Mean of Logged Detects	-0.381	SD of Logged Detects	0.391

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.333	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.578	KM Standard Error of Mean	0.146
KM SD	0.31	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.873	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.819	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.017	95% KM Chebyshev UCL	1.216
97.5% KM Chebyshev UCL	1.491	99% KM Chebyshev UCL	2.033

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.512	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.658	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.312	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	8.158	k star (bias corrected MLE)	2.206
Theta hat (MLE)	0.0892	Theta star (bias corrected MLE)	0.33
nu hat (MLE)	65.26	nu star (bias corrected)	17.65
Mean (detects)	0.728		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.502
Maximum	1.2	Median	0.525
SD	0.43	CV	0.856
k hat (MLE)	0.813	k star (bias corrected MLE)	0.518
Theta hat (MLE)	0.618	Theta star (bias corrected MLE)	0.97
nu hat (MLE)	9.756	nu star (bias corrected)	6.211
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (6.21, α)	1.749	Adjusted Chi Square Value (6.21, β)	1.027
95% Gamma Approximate UCL (use when n>=50)	1.784	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.578	SD (KM)	0.31
Variance (KM)	0.0962	SE of Mean (KM)	0.146
k hat (KM)	3.476	k star (KM)	1.849
nu hat (KM)	41.72	nu star (KM)	22.19
theta hat (KM)	0.166	theta star (KM)	0.313
80% gamma percentile (KM)	0.874	90% gamma percentile (KM)	1.146
95% gamma percentile (KM)	1.406	99% gamma percentile (KM)	1.987

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.19, α)	12.48	Adjusted Chi Square Value (22.19, β)	9.957
95% Gamma Approximate KM-UCL (use when n>=50)	1.028	95% Gamma Adjusted KM-UCL (use when n<50)	1.289

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.565	Mean in Log Scale	-0.734
SD in Original Scale	0.355	SD in Log Scale	0.634
95% t UCL (assumes normality of ROS data)	0.857	95% Percentile Bootstrap UCL	0.803
95% BCA Bootstrap UCL	0.842	95% Bootstrap t UCL	0.968
95% H-UCL (Log ROS)	1.369		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.678	KM Geo Mean	0.508
KM SD (logged)	0.503	95% Critical H Value (KM-Log)	2.646
KM Standard Error of Mean (logged)	0.237	95% H-UCL (KM -Log)	1.045
KM SD (logged)	0.503	95% Critical H Value (KM-Log)	2.646
KM Standard Error of Mean (logged)	0.237		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.532	Mean in Log Scale	-0.909
SD in Original Scale	0.393	SD in Log Scale	0.873
95% t UCL (Assumes normality)	0.855	95% H-Stat UCL	2.492

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.873

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	5.2	Mean	10.67
Maximum	27	Median	6.25
SD	8.677	Std. Error of Mean	3.542
Coefficient of Variation	0.813	Skewness	1.788

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.73	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.335	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	17.8	95% Adjusted-CLT UCL (Chen-1995)	19.26
		95% Modified-t UCL (Johnson-1978)	18.24

Gamma GOF Test

A-D Test Statistic	0.715	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.703	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.328	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.335	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.467	k star (bias corrected MLE)	1.344
Theta hat (MLE)	4.325	Theta star (bias corrected MLE)	7.934
nu hat (MLE)	29.6	nu star (bias corrected)	16.13
MLE Mean (bias corrected)	10.67	MLE Sd (bias corrected)	9.2
		Approximate Chi Square Value (0.05)	8.056
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	6.11

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	21.36	95% Adjusted Gamma UCL (use when n<50)	28.16

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.804	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.294	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.649	Mean of logged Data	2.151
Maximum of Logged Data	3.296	SD of logged Data	0.673

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	27.37	90% Chebyshev (MVUE) UCL	18.81
95% Chebyshev (MVUE) UCL	22.65	97.5% Chebyshev (MVUE) UCL	27.99
99% Chebyshev (MVUE) UCL	38.46		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	16.49	95% Jackknife UCL	17.8
95% Standard Bootstrap UCL	15.98	95% Bootstrap-t UCL	64.95
95% Hall's Bootstrap UCL	75.63	95% Percentile Bootstrap UCL	16.4
95% BCA Bootstrap UCL	19.03		
90% Chebyshev(Mean, Sd) UCL	21.29	95% Chebyshev(Mean, Sd) UCL	26.11
97.5% Chebyshev(Mean, Sd) UCL	32.79	99% Chebyshev(Mean, Sd) UCL	45.91

Suggested UCL to Use

95% Adjusted Gamma UCL	28.16

Recommended UCL exceeds the maximum observation

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	11000	Mean	14000
Maximum	18000	Median	14000
SD	2449	Std. Error of Mean	1000
Coefficient of Variation	0.175	Skewness	0.612

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	16015	95% Adjusted-CLT UCL (Chen-1995)	15912
		95% Modified-t UCL (Johnson-1978)	16057

Gamma GOF Test

A-D Test Statistic	0.248	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.188	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	40.16	k star (bias corrected MLE)	20.19
Theta hat (MLE)	348.6	Theta star (bias corrected MLE)	693.3
nu hat (MLE)	482	nu star (bias corrected)	242.3
MLE Mean (bias corrected)	14000	MLE Sd (bias corrected)	3116
		Approximate Chi Square Value (0.05)	207.3
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	195.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	16367	95% Adjusted Gamma UCL (use when n<50)	17352

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.196	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.306	Mean of logged Data	9.534
Maximum of Logged Data	9.798	SD of logged Data	0.173

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	16415	90% Chebyshev (MVUE) UCL	16957
95% Chebyshev (MVUE) UCL	18297	97.5% Chebyshev (MVUE) UCL	20157
99% Chebyshev (MVUE) UCL	23811		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	15645	95% Jackknife UCL	16015
95% Standard Bootstrap UCL	15489	95% Bootstrap-t UCL	16236
95% Hall's Bootstrap UCL	16603	95% Percentile Bootstrap UCL	15667
95% BCA Bootstrap UCL	15500		
90% Chebyshev(Mean, Sd) UCL	17000	95% Chebyshev(Mean, Sd) UCL	18359
97.5% Chebyshev(Mean, Sd) UCL	20245	99% Chebyshev(Mean, Sd) UCL	23950

Suggested UCL to Use

95% Student's-t UCL	16015

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	180	Mean	328.3
Maximum	410	Median	345
SD	88.86	Std. Error of Mean	36.28
Coefficient of Variation	0.271	Skewness	-0.947

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	401.4	95% Adjusted-CLT UCL (Chen-1995)	373
		95% Modified-t UCL (Johnson-1978)	399.1

Gamma GOF Test

A-D Test Statistic	0.411	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.66	k star (bias corrected MLE)	6.941
Theta hat (MLE)	24.04	Theta star (bias corrected MLE)	47.3
nu hat (MLE)	163.9	nu star (bias corrected)	83.3
MLE Mean (bias corrected)	328.3	MLE Sd (bias corrected)	124.6
		Approximate Chi Square Value (0.05)	63.26
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	56.99

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	432.3	95% Adjusted Gamma UCL (use when n<50)	479.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.204	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.193	Mean of logged Data	5.757
Maximum of Logged Data	6.016	SD of logged Data	0.314

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	455.7	90% Chebyshev (MVUE) UCL	456.1
95% Chebyshev (MVUE) UCL	513.5	97.5% Chebyshev (MVUE) UCL	593.1
99% Chebyshev (MVUE) UCL	749.4		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	388	95% Jackknife UCL	401.4
95% Standard Bootstrap UCL	382.5	95% Bootstrap-t UCL	388.4
95% Hall's Bootstrap UCL	372.9	95% Percentile Bootstrap UCL	381.7
95% BCA Bootstrap UCL	368.3		
90% Chebyshev(Mean, Sd) UCL	437.2	95% Chebyshev(Mean, Sd) UCL	486.5
97.5% Chebyshev(Mean, Sd) UCL	554.9	99% Chebyshev(Mean, Sd) UCL	689.3

Suggested UCL to Use

95% Student's-t UCL	401.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	0.13	Mean	0.484
Maximum	1.125	Median	0.255
SD	0.439	Std. Error of Mean	0.179
Coefficient of Variation	0.907	Skewness	0.962

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.779	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.329	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.845	95% Adjusted-CLT UCL (Chen-1995)	0.854
		95% Modified-t UCL (Johnson-1978)	0.857

Gamma GOF Test

A-D Test Statistic	0.574	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.277	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.337	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.581	k star (bias corrected MLE)	0.902
Theta hat (MLE)	0.306	Theta star (bias corrected MLE)	0.537
nu hat (MLE)	18.97	nu star (bias corrected)	10.82
MLE Mean (bias corrected)	0.484	MLE Sd (bias corrected)	0.51
		Approximate Chi Square Value (0.05)	4.46
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	3.111

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1.175	95% Adjusted Gamma UCL (use when n<50)	1.684

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.873	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.04	Mean of logged Data	-1.074
Maximum of Logged Data	0.118	SD of logged Data	0.904

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	2.372	90% Chebyshev (MVUE) UCL	0.991
95% Chebyshev (MVUE) UCL	1.225	97.5% Chebyshev (MVUE) UCL	1.551
99% Chebyshev (MVUE) UCL	2.19		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.779	95% Jackknife UCL	0.845
95% Standard Bootstrap UCL	0.751	95% Bootstrap-t UCL	2.462
95% Hall's Bootstrap UCL	3.332	95% Percentile Bootstrap UCL	0.775
95% BCA Bootstrap UCL	0.795		
90% Chebyshev(Mean, Sd) UCL	1.022	95% Chebyshev(Mean, Sd) UCL	1.266
97.5% Chebyshev(Mean, Sd) UCL	1.604	99% Chebyshev(Mean, Sd) UCL	2.268

Suggested UCL to Use

95% Adjusted Gamma UCL	1.684

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	15	Mean	27.92
Maximum	58.5	Median	19.5
SD	17.12	Std. Error of Mean	6.989
Coefficient of Variation	0.613	Skewness	1.493

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.345	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	42	95% Adjusted-CLT UCL (Chen-1995)	43.96
		95% Modified-t UCL (Johnson-1978)	42.71

Gamma GOF Test

A-D Test Statistic	0.601	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.343	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.97	k star (bias corrected MLE)	2.096
Theta hat (MLE)	7.033	Theta star (bias corrected MLE)	13.32
nu hat (MLE)	47.63	nu star (bias corrected)	25.15
MLE Mean (bias corrected)	27.92	MLE Sd (bias corrected)	19.28
		Approximate Chi Square Value (0.05)	14.73
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	11.95

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	47.68	95% Adjusted Gamma UCL (use when n<50)	58.77

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.854	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.314	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.708	Mean of logged Data	3.198
Maximum of Logged Data	4.069	SD of logged Data	0.535

Table B.4.2

Summary of ProUCL Output for EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	54.18	90% Chebyshev (MVUE) UCL	45.53
95% Chebyshev (MVUE) UCL	53.68	97.5% Chebyshev (MVUE) UCL	65
99% Chebyshev (MVUE) UCL	87.23		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	39.41	95% Jackknife UCL	42
95% Standard Bootstrap UCL	38.5	95% Bootstrap-t UCL	113.1
95% Hall's Bootstrap UCL	142.1	95% Percentile Bootstrap UCL	38.83
95% BCA Bootstrap UCL	41.83		
90% Chebyshev(Mean, Sd) UCL	48.88	95% Chebyshev(Mean, Sd) UCL	58.38
97.5% Chebyshev(Mean, Sd) UCL	71.56	99% Chebyshev(Mean, Sd) UCL	97.45

Suggested UCL to Use

95% Adjusted Gamma UCL	58.77

Recommended UCL exceeds the maximum observation

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.3

Summary of ProUCL Input Data for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Aluminum	D_Aluminum
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	19	1	17.85	1	26.5	1	31	0	1.1	0	2400	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	65	1	55	1	94	1	21	0	12	1	2500	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	14	1	12	1	20	1	26	0	0.92	0	9200	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	660	1	690	1	1000	1	87	0	130	1	5000	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	13	1	11	1	14	1	22	0	0.76	0	10000	1
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	1100	1	1100	1	1300	1	130	1	180	1	6700	1
on-site (EU04)	BH146-18	5/17/2018	13-15 ft BGS	13	1	10	1	12	1	36	0	1.2	0		
on-site (EU04)	BH147-18	5/17/2018	12-14 ft BGS	42	1	36	1	55	1	21	0	6.2	1		
on-site (EU04)	BH148-18	5/17/2018	6-8 ft BGS	0.97	0	0.99	0	0.91	0	29	0	1	0	3180	1
on-site (EU04)	BH149-18	5/29/2018	10-12 ft BGS	25	1	27	1	33	1	22	0	0.76	0		
on-site (EU04)	BH150-18	5/29/2018	13-15 ft BGS	110	1	120	1	180	1	24	1	23	1	6830	1
on-site (EU04)	BH151-18	5/29/2018	10-12 ft BGS	150	1	140	1	200	1	22	1	28	1	14000	1
on-site (EU04)	GP08-19	1/15/2019	11.67-12.67 ft BGS											4800	1
on-site (EU04)	TT-17	9/30/2008	14 ft BGS											7500	1
on-site (EU04)	TT-17	9/30/2008	14- ft BGS	1200	1	990	1	1300	1	400	1	140	1	7100	1
on-site (EU04)	TT-17	9/30/2008	5 ft BGS							55	0			8300	1
on-site (EU04)	TT-17	9/30/2008	5- ft BGS	84	1	89	1	120	1			14	1	6000	1

Table B.4.3

Summary of ProUCL Input Data for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Antimony	D_Antimony	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	0.2	0	0.74	1	0.86	1	0.77	1	1200	1	37	1	0.078	0	14	1	37.5	0
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	0.12	0	5	1	0.52	1	2.6	1	6700	1	280	1	0.083	1	9	1	25	0
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	1.1	1	56	1	1.2	1	15	1	9900	1	76	1	1.5	1	70	1	32	0
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	0.34	1	15	1	0.85	1	4.3	1	7900	1	160	1	0.38	1	22	1	110	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	0.22	1	9	1	1.5	0	7.6	1	19000	1	350	1	0.28	1	26	1	28	0
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	0.24	1	8.6	1	1.4	0	6.5	1	14000	1	620	1	0.16	1	20	1	27	1
on-site (EU04)	BH146-18	5/17/2018	13-15 ft BGS																	44	0
on-site (EU04)	BH147-18	5/17/2018	12-14 ft BGS																	26	0
on-site (EU04)	BH148-18	5/17/2018	6-8 ft BGS	0.65	1	10.9	1	1.2	1	2.6	1	12000	1	76	1	0.46	1	13.8	1	36	0
on-site (EU04)	BH149-18	5/29/2018	10-12 ft BGS	6.6	0											0.15	0			37	1
on-site (EU04)	BH150-18	5/29/2018	13-15 ft BGS			6.8	1	1.5	1	6.3	1	14200	1	441	1			18.1	1	210	1
on-site (EU04)	BH151-18	5/29/2018	10-12 ft BGS	0.74	1	32	1	1.2	1	14	1	14000	1	180	1	1.125	1	58.5	1	31	1
on-site (EU04)	GP08-19	1/15/2019	11.67-12.67 ft BGS	0.23	1	7.4	1	0.51	1	5.2	1	11000	1	320	1	0.13	1	15	1		
on-site (EU04)	TT-17	9/30/2008	14 ft BGS	12	1	50	1	0.54	1	27	1	12000	1	280	1	0.96	1	38	1	41	0
on-site (EU04)	TT-17	9/30/2008	14- ft BGS	0.56	1	7.3	1	0.28	0	5.6	1	14000	1	370	1	0.18	1	19	1		
on-site (EU04)	TT-17	9/30/2008	5 ft BGS	0.16	1	10	1	0.28	0	6.9	1	18000	1	410	1	0.3	1	20	1	36	0
on-site (EU04)	TT-17	9/30/2008	5- ft BGS	0.36	1	8.9	1	0.66	1	5.3	1	15000	1	410	1	0.21	1	17	1		

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	3
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	12	Number of Distinct Non-Detects	1
Minimum Detect	13	Minimum Non-Detect	0.97
Maximum Detect	1200	Maximum Non-Detect	0.97
Variance Detects	182929	Percent Non-Detects	7.143%
Mean Detects	268.8	SD Detects	427.7
Median Detects	65	CV Detects	1.591
Skewness Detects	1.673	Kurtosis Detects	1.343
Mean of Logged Detects	4.352	SD of Logged Detects	1.65

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.642	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.379	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	249.7	KM Standard Error of Mean	111.8
KM SD	401.9	95% KM (BCA) UCL	437.4
95% KM (t) UCL	447.7	95% KM (Percentile Bootstrap) UCL	435.4
95% KM (z) UCL	433.6	95% KM Bootstrap t UCL	642.4
90% KM Chebyshev UCL	585.1	95% KM Chebyshev UCL	737.1
97.5% KM Chebyshev UCL	948	99% KM Chebyshev UCL	1362

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.996	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.789	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.51	k star (bias corrected MLE)	0.443
Theta hat (MLE)	527.5	Theta star (bias corrected MLE)	606.4
nu hat (MLE)	13.25	nu star (bias corrected)	11.53
Mean (detects)	268.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	249.6
Maximum	1200	Median	53.5
SD	417.2	CV	1.671
k hat (MLE)	0.369	k star (bias corrected MLE)	0.337
Theta hat (MLE)	677	Theta star (bias corrected MLE)	740
nu hat (MLE)	10.33	nu star (bias corrected)	9.446
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (9.45, α)	3.598	Adjusted Chi Square Value (9.45, β)	3.135
95% Gamma Approximate UCL (use when n>=50)	655.3	95% Gamma Adjusted UCL (use when n<50)	752.2

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	249.7	SD (KM)	401.9
Variance (KM)	161556	SE of Mean (KM)	111.8
k hat (KM)	0.386	k star (KM)	0.351
nu hat (KM)	10.81	nu star (KM)	9.825
theta hat (KM)	647	theta star (KM)	711.7
80% gamma percentile (KM)	395.6	90% gamma percentile (KM)	720.8
95% gamma percentile (KM)	1085	99% gamma percentile (KM)	2014

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.82, α)	3.833	Adjusted Chi Square Value (9.82, β)	3.351
95% Gamma Approximate KM-UCL (use when n>=50)	640.1	95% Gamma Adjusted KM-UCL (use when n<50)	732.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.139	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	249.7	Mean in Log Scale	4.067
SD in Original Scale	417.1	SD in Log Scale	1.91
95% t UCL (assumes normality of ROS data)	447.2	95% Percentile Bootstrap UCL	445.8
95% BCA Bootstrap UCL	470.5	95% Bootstrap t UCL	644.3
95% H-UCL (Log ROS)	3912		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.039	KM Geo Mean	56.75
KM SD (logged)	1.899	95% Critical H Value (KM-Log)	4.472
KM Standard Error of Mean (logged)	0.528	95% H-UCL (KM -Log)	3632
KM SD (logged)	1.899	95% Critical H Value (KM-Log)	4.472
KM Standard Error of Mean (logged)	0.528		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	249.7	Mean in Log Scale	3.989
SD in Original Scale	417.1	SD in Log Scale	2.086
95% t UCL (Assumes normality)	447.1	95% H-Stat UCL	7872

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	642.4	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	732.2

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	3
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	10	Minimum Non-Detect	0.99
Maximum Detect	1100	Maximum Non-Detect	0.99
Variance Detects	156438	Percent Non-Detects	7.143%
Mean Detects	253.7	SD Detects	395.5
Median Detects	55	CV Detects	1.559
Skewness Detects	1.583	Kurtosis Detects	0.943
Mean of Logged Detects	4.278	SD of Logged Detects	1.69

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.653	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.382	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	235.6	KM Standard Error of Mean	103.5
KM SD	371.9	95% KM (BCA) UCL	431.8
95% KM (t) UCL	418.8	95% KM (Percentile Bootstrap) UCL	410.6
95% KM (z) UCL	405.8	95% KM Bootstrap t UCL	540.8
90% KM Chebyshev UCL	546	95% KM Chebyshev UCL	686.6
97.5% KM Chebyshev UCL	881.7	99% KM Chebyshev UCL	1265

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.917	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.79	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.504	k star (bias corrected MLE)	0.439
Theta hat (MLE)	503.2	Theta star (bias corrected MLE)	577.8
nu hat (MLE)	13.11	nu star (bias corrected)	11.42
Mean (detects)	253.7		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	235.6
Maximum	1100	Median	45.5
SD	386	CV	1.639
k hat (MLE)	0.367	k star (bias corrected MLE)	0.336
Theta hat (MLE)	642.1	Theta star (bias corrected MLE)	701.3
nu hat (MLE)	10.27	nu star (bias corrected)	9.405
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (9.40, α)	3.573	Adjusted Chi Square Value (9.40, β)	3.112
95% Gamma Approximate UCL (use when n>=50)	620	95% Gamma Adjusted UCL (use when n<50)	712

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	235.6	SD (KM)	371.9
Variance (KM)	138325	SE of Mean (KM)	103.5
k hat (KM)	0.401	k star (KM)	0.363
nu hat (KM)	11.24	nu star (KM)	10.16
theta hat (KM)	587	theta star (KM)	649.1
80% gamma percentile (KM)	375.3	90% gamma percentile (KM)	676.6
95% gamma percentile (KM)	1012	99% gamma percentile (KM)	1865

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.16, α)	4.044	Adjusted Chi Square Value (10.16, β)	3.547
95% Gamma Approximate KM-UCL (use when n>=50)	592.2	95% Gamma Adjusted KM-UCL (use when n<50)	675.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.14	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	235.6	Mean in Log Scale	3.984
SD in Original Scale	386	SD in Log Scale	1.959
95% t UCL (assumes normality of ROS data)	418.3	95% Percentile Bootstrap UCL	403.2
95% BCA Bootstrap UCL	457.2	95% Bootstrap t UCL	545.3
95% H-UCL (Log ROS)	4447		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.971	KM Geo Mean	53.06
KM SD (logged)	1.915	95% Critical H Value (KM-Log)	4.503
KM Standard Error of Mean (logged)	0.533	95% H-UCL (KM -Log)	3626
KM SD (logged)	1.915	95% Critical H Value (KM-Log)	4.503
KM Standard Error of Mean (logged)	0.533		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	235.6	Mean in Log Scale	3.922
SD in Original Scale	386	SD in Log Scale	2.099
95% t UCL (Assumes normality)	418.3	95% H-Stat UCL	7818

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	540.8	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	675.2

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	3
Number of Detects	13	Number of Non-Detects	1
Number of Distinct Detects	12	Number of Distinct Non-Detects	1
Minimum Detect	12	Minimum Non-Detect	0.91
Maximum Detect	1300	Maximum Non-Detect	0.91
Variance Detects	251884	Percent Non-Detects	7.143%
Mean Detects	335	SD Detects	501.9
Median Detects	94	CV Detects	1.498
Skewness Detects	1.468	Kurtosis Detects	0.401
Mean of Logged Detects	4.613	SD of Logged Detects	1.674

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.652	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.375	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	311.1	KM Standard Error of Mean	131.5
KM SD	472.5	95% KM (BCA) UCL	551.8
95% KM (t) UCL	543.9	95% KM (Percentile Bootstrap) UCL	526
95% KM (z) UCL	527.3	95% KM Bootstrap t UCL	649
90% KM Chebyshev UCL	705.5	95% KM Chebyshev UCL	884.1
97.5% KM Chebyshev UCL	1132	99% KM Chebyshev UCL	1619

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.858	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.788	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.249	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.525	k star (bias corrected MLE)	0.455
Theta hat (MLE)	638.1	Theta star (bias corrected MLE)	736
nu hat (MLE)	13.65	nu star (bias corrected)	11.83
Mean (detects)	335		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	311
Maximum	1300	Median	74.5
SD	490.4	CV	1.577
k hat (MLE)	0.373	k star (bias corrected MLE)	0.341
Theta hat (MLE)	834.3	Theta star (bias corrected MLE)	913.3
nu hat (MLE)	10.44	nu star (bias corrected)	9.535
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (9.54, α)	3.653	Adjusted Chi Square Value (9.54, β)	3.186
95% Gamma Approximate UCL (use when n>=50)	811.8	95% Gamma Adjusted UCL (use when n<50)	931

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	311.1	SD (KM)	472.5
Variance (KM)	223302	SE of Mean (KM)	131.5
k hat (KM)	0.433	k star (KM)	0.388
nu hat (KM)	12.14	nu star (KM)	10.87
theta hat (KM)	717.8	theta star (KM)	801.5
80% gamma percentile (KM)	500.3	90% gamma percentile (KM)	883.4
95% gamma percentile (KM)	1306	99% gamma percentile (KM)	2372

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.87, α)	4.492	Adjusted Chi Square Value (10.87, β)	3.962
95% Gamma Approximate KM-UCL (use when n>=50)	752.8	95% Gamma Adjusted KM-UCL (use when n<50)	853.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	311.2	Mean in Log Scale	4.322
SD in Original Scale	490.3	SD in Log Scale	1.943
95% t UCL (assumes normality of ROS data)	543.2	95% Percentile Bootstrap UCL	531.1
95% BCA Bootstrap UCL	569.3	95% Bootstrap t UCL	653.3
95% H-UCL (Log ROS)	5803		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.277	KM Geo Mean	72.02
KM SD (logged)	1.968	95% Critical H Value (KM-Log)	4.61
KM Standard Error of Mean (logged)	0.547	95% H-UCL (KM -Log)	6174
KM SD (logged)	1.968	95% Critical H Value (KM-Log)	4.61
KM Standard Error of Mean (logged)	0.547		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	311.1	Mean in Log Scale	4.227
SD in Original Scale	490.4	SD in Log Scale	2.161
95% t UCL (Assumes normality)	543.2	95% H-Stat UCL	14177

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	649	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	853.5

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	14	Number of Distinct Observations	11
		Number of Missing Observations	2
Number of Detects	4	Number of Non-Detects	10
Number of Distinct Detects	4	Number of Distinct Non-Detects	8
Minimum Detect	22	Minimum Non-Detect	21
Maximum Detect	400	Maximum Non-Detect	87
Variance Detects	31672	Percent Non-Detects	71.43%
Mean Detects	144	SD Detects	178
Median Detects	77	CV Detects	1.236
Skewness Detects	1.565	Kurtosis Detects	2.197
Mean of Logged Detects	4.282	SD of Logged Detects	1.403

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.811	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	56.43	KM Standard Error of Mean	30.64
KM SD	99.27	95% KM (BCA) UCL	N/A
95% KM (t) UCL	110.7	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	106.8	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	148.3	95% KM Chebyshev UCL	190
97.5% KM Chebyshev UCL	247.8	99% KM Chebyshev UCL	361.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.403	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.669	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.313	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.404	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.855	k star (bias corrected MLE)	0.381
Theta hat (MLE)	168.3	Theta star (bias corrected MLE)	378.4
nu hat (MLE)	6.843	nu star (bias corrected)	3.044
Mean (detects)	144		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	41.15
Maximum	400	Median	0.01
SD	108.9	CV	2.647
k hat (MLE)	0.135	k star (bias corrected MLE)	0.154
Theta hat (MLE)	305	Theta star (bias corrected MLE)	267.8
nu hat (MLE)	3.778	nu star (bias corrected)	4.302
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.30, α)	0.844	Adjusted Chi Square Value (4.30, β)	0.665
95% Gamma Approximate UCL (use when n>=50)	209.6	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	56.43	SD (KM)	99.27
Variance (KM)	9855	SE of Mean (KM)	30.64
k hat (KM)	0.323	k star (KM)	0.301
nu hat (KM)	9.047	nu star (KM)	8.442
theta hat (KM)	174.6	theta star (KM)	187.2
80% gamma percentile (KM)	86.64	90% gamma percentile (KM)	166.3
95% gamma percentile (KM)	257.7	99% gamma percentile (KM)	495.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.44, α)	2.993	Adjusted Chi Square Value (8.44, β)	2.579
95% Gamma Approximate KM-UCL (use when n>=50)	159.1	95% Gamma Adjusted KM-UCL (use when n<50)	184.7

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	43.23	Mean in Log Scale	1.875
SD in Original Scale	108.1	SD in Log Scale	1.813
95% t UCL (assumes normality of ROS data)	94.39	95% Percentile Bootstrap UCL	92.7
95% BCA Bootstrap UCL	126.9	95% Bootstrap t UCL	589.8
95% H-UCL (Log ROS)	293.7		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.411	KM Geo Mean	30.29
KM SD (logged)	0.852	95% Critical H Value (KM-Log)	2.557
KM Standard Error of Mean (logged)	0.263	95% H-UCL (KM -Log)	79.72
KM SD (logged)	0.852	95% Critical H Value (KM-Log)	2.557
KM Standard Error of Mean (logged)	0.263		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	53.64	Mean in Log Scale	3.185
SD in Original Scale	104.4	SD in Log Scale	1.061
95% t UCL (Assumes normality)	103.1	95% H-Stat UCL	99.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	110.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	3
Number of Detects	8	Number of Non-Detects	6
Number of Distinct Detects	8	Number of Distinct Non-Detects	5
Minimum Detect	6.2	Minimum Non-Detect	0.76
Maximum Detect	180	Maximum Non-Detect	1.2
Variance Detects	5008	Percent Non-Detects	42.86%
Mean Detects	66.65	SD Detects	70.76
Median Detects	25.5	CV Detects	1.062
Skewness Detects	0.771	Kurtosis Detects	-1.537
Mean of Logged Detects	3.552	SD of Logged Detects	1.284

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.788	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.333	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	38.41	KM Standard Error of Mean	17.06
KM SD	59.72	95% KM (BCA) UCL	66.5
95% KM (t) UCL	68.63	95% KM (Percentile Bootstrap) UCL	66.22
95% KM (z) UCL	66.48	95% KM Bootstrap t UCL	77.86
90% KM Chebyshev UCL	89.6	95% KM Chebyshev UCL	112.8
97.5% KM Chebyshev UCL	145	99% KM Chebyshev UCL	208.2

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.605	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.261	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.302	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.903	k star (bias corrected MLE)	0.648
Theta hat (MLE)	73.81	Theta star (bias corrected MLE)	102.9
nu hat (MLE)	14.45	nu star (bias corrected)	10.36
Mean (detects)	66.65		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	38.09
Maximum	180	Median	9.1
SD	62.19	CV	1.633
k hat (MLE)	0.205	k star (bias corrected MLE)	0.208
Theta hat (MLE)	186.2	Theta star (bias corrected MLE)	182.8
nu hat (MLE)	5.729	nu star (bias corrected)	5.835
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (5.83, α)	1.556	Adjusted Chi Square Value (5.83, β)	1.283
95% Gamma Approximate UCL (use when n>=50)	142.8	95% Gamma Adjusted UCL (use when n<50)	173.2

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	38.41	SD (KM)	59.72
Variance (KM)	3567	SE of Mean (KM)	17.06
k hat (KM)	0.414	k star (KM)	0.373
nu hat (KM)	11.58	nu star (KM)	10.43
theta hat (KM)	92.86	theta star (KM)	103.1
80% gamma percentile (KM)	61.42	90% gamma percentile (KM)	109.8
95% gamma percentile (KM)	163.5	99% gamma percentile (KM)	299.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.43, α)	4.214	Adjusted Chi Square Value (10.43, β)	3.704
95% Gamma Approximate KM-UCL (use when n>=50)	95.09	95% Gamma Adjusted KM-UCL (use when n<50)	108.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	38.63	Mean in Log Scale	2.105
SD in Original Scale	61.84	SD in Log Scale	1.987
95% t UCL (assumes normality of ROS data)	67.9	95% Percentile Bootstrap UCL	66.66
95% BCA Bootstrap UCL	72.08	95% Bootstrap t UCL	81.54
95% H-UCL (Log ROS)	765.7		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.912	KM Geo Mean	6.768
KM SD (logged)	2.1	95% Critical H Value (KM-Log)	4.877
KM Standard Error of Mean (logged)	0.6	95% H-UCL (KM -Log)	1051
KM SD (logged)	2.1	95% Critical H Value (KM-Log)	4.877
KM Standard Error of Mean (logged)	0.6		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	38.29	Mean in Log Scale	1.707
SD in Original Scale	62.06	SD in Log Scale	2.406
95% t UCL (Assumes normality)	67.66	95% H-Stat UCL	3916

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	77.86	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	108.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	3
Minimum	2400	Mean	6679
Maximum	14000	Median	6765
SD	3154	Std. Error of Mean	842.9
Coefficient of Variation	0.472	Skewness	0.698

Normal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.112	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8172	95% Adjusted-CLT UCL (Chen-1995)	8234
		95% Modified-t UCL (Johnson-1978)	8198

Gamma GOF Test

A-D Test Statistic	0.267	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.136	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.23	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.557	k star (bias corrected MLE)	3.628
Theta hat (MLE)	1466	Theta star (bias corrected MLE)	1841
nu hat (MLE)	127.6	nu star (bias corrected)	101.6
MLE Mean (bias corrected)	6679	MLE Sd (bias corrected)	3507
		Approximate Chi Square Value (0.05)	79.32
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	76.72

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8553	95% Adjusted Gamma UCL (use when n<50)	8844

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.783	Mean of logged Data	8.693
Maximum of Logged Data	9.547	SD of logged Data	0.516

Assuming Lognormal Distribution

95% H-UCL	9107	90% Chebyshev (MVUE) UCL	9613
95% Chebyshev (MVUE) UCL	10915	97.5% Chebyshev (MVUE) UCL	12721
99% Chebyshev (MVUE) UCL	16269		

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8066	95% Jackknife UCL	8172
95% Standard Bootstrap UCL	8017	95% Bootstrap-t UCL	8378
95% Hall's Bootstrap UCL	8562	95% Percentile Bootstrap UCL	8058
95% BCA Bootstrap UCL	8219		
90% Chebyshev(Mean, Sd) UCL	9208	95% Chebyshev(Mean, Sd) UCL	10353
97.5% Chebyshev(Mean, Sd) UCL	11943	99% Chebyshev(Mean, Sd) UCL	15066

Suggested UCL to Use

95% Student's-t UCL	8172

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	3
Number of Detects	11	Number of Non-Detects	3
Number of Distinct Detects	11	Number of Distinct Non-Detects	3
Minimum Detect	0.16	Minimum Non-Detect	0.12
Maximum Detect	12	Maximum Non-Detect	6.6
Variance Detects	12.19	Percent Non-Detects	21.43%
Mean Detects	1.509	SD Detects	3.491
Median Detects	0.36	CV Detects	2.313
Skewness Detects	3.277	Kurtosis Detects	10.81
Mean of Logged Detects	-0.643	SD of Logged Detects	1.196

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.415	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.456	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.233	KM Standard Error of Mean	0.841
KM SD	2.999	95% KM (BCA) UCL	2.923
95% KM (t) UCL	2.722	95% KM (Percentile Bootstrap) UCL	2.871
95% KM (z) UCL	2.616	95% KM Bootstrap t UCL	14.21
90% KM Chebyshev UCL	3.756	95% KM Chebyshev UCL	4.899
97.5% KM Chebyshev UCL	6.485	99% KM Chebyshev UCL	9.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.745	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.775	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.331	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.268	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.588	k star (bias corrected MLE)	0.488
Theta hat (MLE)	2.568	Theta star (bias corrected MLE)	3.093
nu hat (MLE)	12.93	nu star (bias corrected)	10.74
Mean (detects)	1.509		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.188
Maximum	12	Median	0.29
SD	3.128	CV	2.633
k hat (MLE)	0.396	k star (bias corrected MLE)	0.359
Theta hat (MLE)	3	Theta star (bias corrected MLE)	3.311
nu hat (MLE)	11.09	nu star (bias corrected)	10.05
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (10.05, α)	3.97	Adjusted Chi Square Value (10.05, β)	3.478
95% Gamma Approximate UCL (use when n>=50)	3.006	95% Gamma Adjusted UCL (use when n<50)	3.431

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.233	SD (KM)	2.999
Variance (KM)	8.994	SE of Mean (KM)	0.841
k hat (KM)	0.169	k star (KM)	0.18
nu hat (KM)	4.735	nu star (KM)	5.053
theta hat (KM)	7.293	theta star (KM)	6.833
80% gamma percentile (KM)	1.533	90% gamma percentile (KM)	3.72
95% gamma percentile (KM)	6.52	99% gamma percentile (KM)	14.36

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.05, α)	1.177	Adjusted Chi Square Value (5.05, β)	0.951
95% Gamma Approximate KM-UCL (use when n>=50)	5.295	95% Gamma Adjusted KM-UCL (use when n<50)	6.555

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.805	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.215	Mean in Log Scale	-1.019
SD in Original Scale	3.118	SD in Log Scale	1.358
95% t UCL (assumes normality of ROS data)	2.691	95% Percentile Bootstrap UCL	2.852
95% BCA Bootstrap UCL	3.748	95% Bootstrap t UCL	14.82
95% H-UCL (Log ROS)	3.299		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.879	KM Geo Mean	0.415
KM SD (logged)	1.14	95% Critical H Value (KM-Log)	3.03
KM Standard Error of Mean (logged)	0.324	95% H-UCL (KM -Log)	2.074
KM SD (logged)	1.14	95% Critical H Value (KM-Log)	3.03
KM Standard Error of Mean (logged)	0.324		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.433	Mean in Log Scale	-0.786
SD in Original Scale	3.151	SD in Log Scale	1.383
95% t UCL (Assumes normality)	2.924	95% H-Stat UCL	4.485

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	4.899

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	3
Minimum	0.74	Mean	16.26
Maximum	56	Median	8.95
SD	17.13	Std. Error of Mean	4.579
Coefficient of Variation	1.054	Skewness	1.713

Normal GOF Test

Shapiro Wilk Test Statistic	0.711	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.337	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	24.37	95% Adjusted-CLT UCL (Chen-1995)	26.03
		95% Modified-t UCL (Johnson-1978)	24.72

Gamma GOF Test

A-D Test Statistic	0.931	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.254	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.234	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.218	k star (bias corrected MLE)	1.005
Theta hat (MLE)	13.35	Theta star (bias corrected MLE)	16.18
nu hat (MLE)	34.11	nu star (bias corrected)	28.14
MLE Mean (bias corrected)	16.26	MLE Sd (bias corrected)	16.22
		Approximate Chi Square Value (0.05)	17.03
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	15.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	26.86	95% Adjusted Gamma UCL (use when n<50)	28.78

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.208	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.301	Mean of logged Data	2.325
Maximum of Logged Data	4.025	SD of logged Data	1.064

Assuming Lognormal Distribution

95% H-UCL	42.39	90% Chebyshev (MVUE) UCL	32.87
95% Chebyshev (MVUE) UCL	40.05	97.5% Chebyshev (MVUE) UCL	50.03
99% Chebyshev (MVUE) UCL	69.61		

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	23.79	95% Jackknife UCL	24.37
95% Standard Bootstrap UCL	23.57	95% Bootstrap-t UCL	31.5
95% Hall's Bootstrap UCL	26.96	95% Percentile Bootstrap UCL	24.01
95% BCA Bootstrap UCL	25.41		
90% Chebyshev(Mean, Sd) UCL	30	95% Chebyshev(Mean, Sd) UCL	36.22
97.5% Chebyshev(Mean, Sd) UCL	44.86	99% Chebyshev(Mean, Sd) UCL	61.82

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	36.22

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	10	Number of Non-Detects	4
Number of Distinct Detects	8	Number of Distinct Non-Detects	3
Minimum Detect	0.51	Minimum Non-Detect	0.28
Maximum Detect	1.5	Maximum Non-Detect	1.5
Variance Detects	0.124	Percent Non-Detects	28.57%
Mean Detects	0.904	SD Detects	0.352
Median Detects	0.855	CV Detects	0.39
Skewness Detects	0.345	Kurtosis Detects	-1.28
Mean of Logged Detects	-0.172	SD of Logged Detects	0.402

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.791	KM Standard Error of Mean	0.113
KM SD	0.378	95% KM (BCA) UCL	0.981
95% KM (t) UCL	0.991	95% KM (Percentile Bootstrap) UCL	0.975
95% KM (z) UCL	0.977	95% KM Bootstrap t UCL	1
90% KM Chebyshev UCL	1.131	95% KM Chebyshev UCL	1.285
97.5% KM Chebyshev UCL	1.498	99% KM Chebyshev UCL	1.918

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.508	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.221	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	7.199	k star (bias corrected MLE)	5.106
Theta hat (MLE)	0.126	Theta star (bias corrected MLE)	0.177
nu hat (MLE)	144	nu star (bias corrected)	102.1
Mean (detects)	0.904		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.255	Mean	0.792
Maximum	1.5	Median	0.719
SD	0.365	CV	0.462
k hat (MLE)	4.757	k star (bias corrected MLE)	3.785
Theta hat (MLE)	0.166	Theta star (bias corrected MLE)	0.209
nu hat (MLE)	133.2	nu star (bias corrected)	106
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (105.99, α)	83.23	Adjusted Chi Square Value (105.99, β)	80.56
95% Gamma Approximate UCL (use when n>=50)	1.008	95% Gamma Adjusted UCL (use when n<50)	1.042

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.791	SD (KM)	0.378
Variance (KM)	0.143	SE of Mean (KM)	0.113
k hat (KM)	4.384	k star (KM)	3.492
nu hat (KM)	122.8	nu star (KM)	97.78
theta hat (KM)	0.18	theta star (KM)	0.226
80% gamma percentile (KM)	1.108	90% gamma percentile (KM)	1.358
95% gamma percentile (KM)	1.59	99% gamma percentile (KM)	2.089

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (97.78, α)	75.97	Adjusted Chi Square Value (97.78, β)	73.43
95% Gamma Approximate KM-UCL (use when n>=50)	1.018	95% Gamma Adjusted KM-UCL (use when n<50)	1.053

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.795	Mean in Log Scale	-0.323
SD in Original Scale	0.355	SD in Log Scale	0.456
95% t UCL (assumes normality of ROS data)	0.964	95% Percentile Bootstrap UCL	0.959
95% BCA Bootstrap UCL	0.961	95% Bootstrap t UCL	0.988
95% H-UCL (Log ROS)	1.035		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.365	KM Geo Mean	0.694
KM SD (logged)	0.534	95% Critical H Value (KM-Log)	2.056
KM Standard Error of Mean (logged)	0.162	95% H-UCL (KM -Log)	1.085
KM SD (logged)	0.534	95% Critical H Value (KM-Log)	2.056
KM Standard Error of Mean (logged)	0.162		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.769	Mean in Log Scale	-0.45
SD in Original Scale	0.402	SD in Log Scale	0.726
95% t UCL (Assumes normality)	0.959	95% H-Stat UCL	1.339

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.991

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	3
Minimum	0.77	Mean	7.834
Maximum	27	Median	5.95
SD	6.778	Std. Error of Mean	1.812
Coefficient of Variation	0.865	Skewness	1.991

Normal GOF Test

Shapiro Wilk Test Statistic	0.781	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	11.04	95% Adjusted-CLT UCL (Chen-1995)	11.84
		95% Modified-t UCL (Johnson-1978)	11.2

Gamma GOF Test

A-D Test Statistic	0.45	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.201	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.232	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.755	k star (bias corrected MLE)	1.427
Theta hat (MLE)	4.463	Theta star (bias corrected MLE)	5.49
nu hat (MLE)	49.15	nu star (bias corrected)	39.95
MLE Mean (bias corrected)	7.834	MLE Sd (bias corrected)	6.558
		Approximate Chi Square Value (0.05)	26.47
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	25.02

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	11.82	95% Adjusted Gamma UCL (use when n<50)	12.51

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.169	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.261	Mean of logged Data	1.747
Maximum of Logged Data	3.296	SD of logged Data	0.861

Assuming Lognormal Distribution

95% H-UCL	15.37	90% Chebyshev (MVUE) UCL	13.97
95% Chebyshev (MVUE) UCL	16.66	97.5% Chebyshev (MVUE) UCL	20.4
99% Chebyshev (MVUE) UCL	27.73		

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	10.81	95% Jackknife UCL	11.04
95% Standard Bootstrap UCL	10.74	95% Bootstrap-t UCL	13.3
95% Hall's Bootstrap UCL	21.55	95% Percentile Bootstrap UCL	10.88
95% BCA Bootstrap UCL	11.76		
90% Chebyshev(Mean, Sd) UCL	13.27	95% Chebyshev(Mean, Sd) UCL	15.73
97.5% Chebyshev(Mean, Sd) UCL	19.15	99% Chebyshev(Mean, Sd) UCL	25.86

Suggested UCL to Use

95% Adjusted Gamma UCL	12.51

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	14	Number of Distinct Observations	11
		Number of Missing Observations	3
Minimum	1200	Mean	12064
Maximum	19000	Median	13000
SD	4622	Std. Error of Mean	1235
Coefficient of Variation	0.383	Skewness	-0.837

Normal GOF Test

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	14252	95% Adjusted-CLT UCL (Chen-1995)	13801
		95% Modified-t UCL (Johnson-1978)	14206

Gamma GOF Test

A-D Test Statistic	1.076	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.741	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.23	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.769	k star (bias corrected MLE)	3.009
Theta hat (MLE)	3201	Theta star (bias corrected MLE)	4009
nu hat (MLE)	105.5	nu star (bias corrected)	84.26
MLE Mean (bias corrected)	12064	MLE Sd (bias corrected)	6955
		Approximate Chi Square Value (0.05)	64.1
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	61.77

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	15858	95% Adjusted Gamma UCL (use when n<50)	16456

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.682	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.09	Mean of logged Data	9.26
Maximum of Logged Data	9.852	SD of logged Data	0.687

Assuming Lognormal Distribution

95% H-UCL	20709	90% Chebyshev (MVUE) UCL	20572
95% Chebyshev (MVUE) UCL	23985	97.5% Chebyshev (MVUE) UCL	28721
99% Chebyshev (MVUE) UCL	38025		

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	14096	95% Jackknife UCL	14252
95% Standard Bootstrap UCL	14008	95% Bootstrap-t UCL	14025
95% Hall's Bootstrap UCL	13865	95% Percentile Bootstrap UCL	14021
95% BCA Bootstrap UCL	13729		
90% Chebyshev(Mean, Sd) UCL	15770	95% Chebyshev(Mean, Sd) UCL	17449
97.5% Chebyshev(Mean, Sd) UCL	19779	99% Chebyshev(Mean, Sd) UCL	24356

Suggested UCL to Use

95% Student's-t UCL	14252

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	14	Number of Distinct Observations	11
		Number of Missing Observations	3
Minimum	37	Mean	286.4
Maximum	620	Median	300
SD	165.5	Std. Error of Mean	44.23
Coefficient of Variation	0.578	Skewness	0.16

Normal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.127	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	364.8	95% Adjusted-CLT UCL (Chen-1995)	361.2
		95% Modified-t UCL (Johnson-1978)	365.1

Gamma GOF Test

A-D Test Statistic	0.551	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.231	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.271	k star (bias corrected MLE)	1.832
Theta hat (MLE)	126.1	Theta star (bias corrected MLE)	156.3
nu hat (MLE)	63.6	nu star (bias corrected)	51.3
MLE Mean (bias corrected)	286.4	MLE Sd (bias corrected)	211.6
		Approximate Chi Square Value (0.05)	35.85
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	34.15

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	409.9	95% Adjusted Gamma UCL (use when n<50)	430.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.611	Mean of logged Data	5.421
Maximum of Logged Data	6.43	SD of logged Data	0.815

Assuming Lognormal Distribution

95% H-UCL	555.4	90% Chebyshev (MVUE) UCL	519.2
95% Chebyshev (MVUE) UCL	615.6	97.5% Chebyshev (MVUE) UCL	749.5
99% Chebyshev (MVUE) UCL	1013		

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	359.2	95% Jackknife UCL	364.8
95% Standard Bootstrap UCL	357.3	95% Bootstrap-t UCL	366.2
95% Hall's Bootstrap UCL	364.8	95% Percentile Bootstrap UCL	353.4
95% BCA Bootstrap UCL	353.8		
90% Chebyshev(Mean, Sd) UCL	419.1	95% Chebyshev(Mean, Sd) UCL	479.2
97.5% Chebyshev(Mean, Sd) UCL	562.6	99% Chebyshev(Mean, Sd) UCL	726.5

Suggested UCL to Use

95% Student's-t UCL	364.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	3
Number of Detects	12	Number of Non-Detects	2
Number of Distinct Detects	12	Number of Distinct Non-Detects	2
Minimum Detect	0.083	Minimum Non-Detect	0.078
Maximum Detect	1.5	Maximum Non-Detect	0.15
Variance Detects	0.21	Percent Non-Detects	14.29%
Mean Detects	0.481	SD Detects	0.459
Median Detects	0.29	CV Detects	0.954
Skewness Detects	1.396	Kurtosis Detects	0.847
Mean of Logged Detects	-1.115	SD of Logged Detects	0.903

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.793	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.425	KM Standard Error of Mean	0.12
KM SD	0.429	95% KM (BCA) UCL	0.656
95% KM (t) UCL	0.637	95% KM (Percentile Bootstrap) UCL	0.637
95% KM (z) UCL	0.622	95% KM Bootstrap t UCL	0.749
90% KM Chebyshev UCL	0.784	95% KM Chebyshev UCL	0.947
97.5% KM Chebyshev UCL	1.173	99% KM Chebyshev UCL	1.617

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.504	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.178	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.453	k star (bias corrected MLE)	1.145
Theta hat (MLE)	0.331	Theta star (bias corrected MLE)	0.42
nu hat (MLE)	34.87	nu star (bias corrected)	27.48
Mean (detects)	0.481		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.413
Maximum	1.5	Median	0.245
SD	0.455	CV	1.101
k hat (MLE)	0.811	k star (bias corrected MLE)	0.685
Theta hat (MLE)	0.509	Theta star (bias corrected MLE)	0.603
nu hat (MLE)	22.72	nu star (bias corrected)	19.19
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (19.19, α)	10.25	Adjusted Chi Square Value (19.19, β)	9.396
95% Gamma Approximate UCL (use when n>=50)	0.774	95% Gamma Adjusted UCL (use when n<50)	0.844

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.425	SD (KM)	0.429
Variance (KM)	0.184	SE of Mean (KM)	0.12
k hat (KM)	0.978	k star (KM)	0.816
nu hat (KM)	27.37	nu star (KM)	22.84
theta hat (KM)	0.434	theta star (KM)	0.52
80% gamma percentile (KM)	0.693	90% gamma percentile (KM)	1.027
95% gamma percentile (KM)	1.367	99% gamma percentile (KM)	2.169

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.84, α)	12.97	Adjusted Chi Square Value (22.84, β)	11.99
95% Gamma Approximate KM-UCL (use when n>=50)	0.748	95% Gamma Adjusted KM-UCL (use when n<50)	0.809

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.956	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.133	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.42	Mean in Log Scale	-1.382
SD in Original Scale	0.45	SD in Log Scale	1.082
95% t UCL (assumes normality of ROS data)	0.632	95% Percentile Bootstrap UCL	0.623
95% BCA Bootstrap UCL	0.669	95% Bootstrap t UCL	0.74
95% H-UCL (Log ROS)	1.085		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.306	KM Geo Mean	0.271
KM SD (logged)	0.931	95% Critical H Value (KM-Log)	2.679
KM Standard Error of Mean (logged)	0.261	95% H-UCL (KM -Log)	0.834
KM SD (logged)	0.931	95% Critical H Value (KM-Log)	2.679
KM Standard Error of Mean (logged)	0.261		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.42	Mean in Log Scale	-1.372
SD in Original Scale	0.449	SD in Log Scale	1.065
95% t UCL (Assumes normality)	0.633	95% H-Stat UCL	1.054

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.809	95% GROS Adjusted Gamma UCL	0.844

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	3
Minimum	9	Mean	25.74
Maximum	70	Median	19.5
SD	17.8	Std. Error of Mean	4.757
Coefficient of Variation	0.691	Skewness	1.791

Normal GOF Test

Shapiro Wilk Test Statistic	0.749	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.298	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	34.17	95% Adjusted-CLT UCL (Chen-1995)	36
		95% Modified-t UCL (Johnson-1978)	34.55

Gamma GOF Test

A-D Test Statistic	0.913	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.742	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.246	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.23	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.154	k star (bias corrected MLE)	2.525
Theta hat (MLE)	8.163	Theta star (bias corrected MLE)	10.19
nu hat (MLE)	88.3	nu star (bias corrected)	70.71
MLE Mean (bias corrected)	25.74	MLE Sd (bias corrected)	16.2
		Approximate Chi Square Value (0.05)	52.35
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	50.26

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	34.77	95% Adjusted Gamma UCL (use when n<50)	36.22

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.197	Mean of logged Data	3.081
Maximum of Logged Data	4.248	SD of logged Data	0.564

Assuming Lognormal Distribution

95% H-UCL	35.55	90% Chebyshev (MVUE) UCL	37.01
95% Chebyshev (MVUE) UCL	42.36	97.5% Chebyshev (MVUE) UCL	49.77
99% Chebyshev (MVUE) UCL	64.34		

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	33.57	95% Jackknife UCL	34.17
95% Standard Bootstrap UCL	33.3	95% Bootstrap-t UCL	43.55
95% Hall's Bootstrap UCL	66.4	95% Percentile Bootstrap UCL	33.29
95% BCA Bootstrap UCL	35.79		
90% Chebyshev(Mean, Sd) UCL	40.01	95% Chebyshev(Mean, Sd) UCL	46.48
97.5% Chebyshev(Mean, Sd) UCL	55.45	99% Chebyshev(Mean, Sd) UCL	73.07

Suggested UCL to Use

95% H-UCL	35.55

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	2
Number of Detects	5	Number of Non-Detects	9
Number of Distinct Detects	5	Number of Distinct Non-Detects	8
Minimum Detect	27	Minimum Non-Detect	25
Maximum Detect	210	Maximum Non-Detect	44
Variance Detects	6204	Percent Non-Detects	64.29%
Mean Detects	83	SD Detects	78.76
Median Detects	37	CV Detects	0.949
Skewness Detects	1.411	Kurtosis Detects	1.17
Mean of Logged Detects	4.078	SD of Logged Detects	0.9

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.32	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	46.75	KM Standard Error of Mean	14.99
KM SD	50.08	95% KM (BCA) UCL	72.86
95% KM (t) UCL	73.29	95% KM (Percentile Bootstrap) UCL	71.4
95% KM (z) UCL	71.4	95% KM Bootstrap t UCL	224.3
90% KM Chebyshev UCL	91.71	95% KM Chebyshev UCL	112.1
97.5% KM Chebyshev UCL	140.3	99% KM Chebyshev UCL	195.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.514	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.686	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.334	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.361	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.612	k star (bias corrected MLE)	0.778
Theta hat (MLE)	51.49	Theta star (bias corrected MLE)	106.7
nu hat (MLE)	16.12	nu star (bias corrected)	7.781
Mean (detects)	83		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	29.65
Maximum	210	Median	0.01
SD	60.1	CV	2.027
k hat (MLE)	0.156	k star (bias corrected MLE)	0.17
Theta hat (MLE)	189.9	Theta star (bias corrected MLE)	174.1
nu hat (MLE)	4.372	nu star (bias corrected)	4.768
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (4.77, α)	1.047	Adjusted Chi Square Value (4.77, β)	0.838
95% Gamma Approximate UCL (use when n>=50)	135.1	95% Gamma Adjusted UCL (use when n<50)	168.7

Table B.4.4

Summary of ProUCL Output for EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 11:58:41 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	46.75	SD (KM)	50.08
Variance (KM)	2508	SE of Mean (KM)	14.99
k hat (KM)	0.872	k star (KM)	0.732
nu hat (KM)	24.4	nu star (KM)	20.51
theta hat (KM)	53.64	theta star (KM)	63.83
80% gamma percentile (KM)	76.72	90% gamma percentile (KM)	116.1
95% gamma percentile (KM)	156.5	99% gamma percentile (KM)	252.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.51, α)	11.23	Adjusted Chi Square Value (20.51, β)	10.32
95% Gamma Approximate KM-UCL (use when n>=50)	85.4	95% Gamma Adjusted KM-UCL (use when n<50)	92.86

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.859	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.298	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	37.45	Mean in Log Scale	3.017
SD in Original Scale	56.24	SD in Log Scale	1.011
95% t UCL (assumes normality of ROS data)	64.07	95% Percentile Bootstrap UCL	64.22
95% BCA Bootstrap UCL	74.1	95% Bootstrap t UCL	159.8
95% H-UCL (Log ROS)	74.94		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.562	KM Geo Mean	35.25
KM SD (logged)	0.621	95% Critical H Value (KM-Log)	2.238
KM Standard Error of Mean (logged)	0.188	95% H-UCL (KM -Log)	62.82
KM SD (logged)	0.621	95% Critical H Value (KM-Log)	2.238
KM Standard Error of Mean (logged)	0.188		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	40.55	Mean in Log Scale	3.265
SD in Original Scale	54.71	SD in Log Scale	0.818
95% t UCL (Assumes normality)	66.45	95% H-Stat UCL	64.6

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	73.29

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.1

Summary of ProUCL Input Data for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	**Benzo(a)anthracene**	**D_Benzo(a)anthracene**	**Benzo(a)pyrene**	**D_Benzo(a)pyrene**	**Benzo(b)fluoranthene**	**D_Benzo(b)fluoranthene**	**Benzo(k)fluoranthene**	**D_Benzo(k)fluoranthene**	**Carbazole**	**D_Carbazole**	**Chrysene**	**D_Chrysene**
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	260000	1	270000	1	330000	1	130000	1	92000	1	250000	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	440	1	680	1	960	1	510	1	200	0	580	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	1400	1	1500	1	2000	1	790	1	160	1	1400	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	63	1	59	1	70	1	30	1	21	0	57	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	49	1	43	1	67	1	27	1	22	0	61	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	800	1	730	1	870	1	340	1	81	0	830	1
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	19	1	17.85	1	26.5	1	12	1	31	0	20	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	65	1	55	1	94	1	28	1	21	0	97	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	14	1	12	1	20	1	7.1	1	26	0	17	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	660	1	690	1	1000	1	410	1	87	0	730	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	13	1	11	1	14	1	0.78	0	22	0	13	1
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	1100	1	1100	1	1300	1	480	1	130	1	1100	1

Table B.5.1

Summary of ProUCL Input Data for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

EU:	Sample Location:	Sample Date:	Sample Depth:	12 Dibenz(a,h)anthracene	13 D_Dibenz(a,h)anthracene	14 Dibenzofuran	15 D_Dibenzofuran	16 Fluoranthene	17 D_Fluoranthene	18 Indeno(1,2,3-cd)pyrene	19 D_Indeno(1,2,3-cd)pyrene	20 Naphthalene	21 D_Naphthalene
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	39000	1	30000	1	590000	1	120000	1	18000	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	7	0	140	0	800	1	410	1	8.7	0
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	230	1	72	1	2700	1	770	1	110	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	0.74	0	15	0	100	1	30	1	0.92	0
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	9.3	1	15	0	110	1	31	1	8	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	100	1	56	0	1900	1	370	1	21	1
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	1.1	0	21	0	45.5	1	9.25	1	14.5	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	12	1	67	1	99	1	32	1	150	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	0.92	0	18	0	33	1	7	1	10	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	130	1	59	0	1200	1	350	1	21	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	0.76	0	16	1	19	1	0.4	0	48	1
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	180	1	100	1	2900	1	610	1	91	1

Table B.5.1

Summary of ProUCL Input Data for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

EU:	Sample Location:	Sample Date:	Sample Depth:	22 Phenanthrene	23 D_Phenanthrene	24 Pyrene	25 D_Pyrene	26 Aluminum	27 D_Aluminum	28 Antimony	29 D_Antimony	30 Arsenic	31 D_Arsenic	32 Chromium VI (hexavalent)	33 D_Chromium VI (hexavalent)
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	480000	1	450000	1	5900	1	1.1	1	9.4	1	0.27	0
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	360	1	890	1	9800	1	0.13	1	1.8	1	0.66	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	940	1	2300	1	5100	1	0.15	1	6	1	0.85	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	48	1	93	1	6200	1	0.13	0	6.1	1	1.4	0
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	80	1	90	1	7200	1	0.59	1	7	1	0.27	0
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	490	1	1700	1	3500	1	0.15	1	5.7	1	0.26	0
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	29.5	1	41	1	14000	1	0.74	1	32	1	1.2	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	210	1	100	1	4800	1	0.23	1	7.4	1	0.51	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	15	1	29	1	7500	1	12	1	50	1	0.54	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	490	1	1100	1	7100	1	0.56	1	7.3	1	0.28	0
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	59	1	20	1	8300	1	0.16	1	10	1	0.28	0
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	1900	1	2400	1	6000	1	0.36	1	8.9	1	0.66	1

Table B.5.1

Summary of ProUCL Input Data for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				34	35	36	37	38	39	40	41	42	43	44	45
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	**Cobalt**	**D_Cobalt**	**Iron**	**D_Iron**	**Lead**	**D_Lead**	**Manganese**	**D_Manganese**	**Thallium**	**D_Thallium**	**Vanadium**	**D_Vanadium**
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	5.1	1	22000	1	1000	1	390	1	0.25	1	18	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	1.2	1	54000	1	14	1	6000	1	0.046	0	170	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	5.3	1	14000	1	26	1	580	1	0.19	1	22	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	4.6	1	14000	1	49	1	390	1	0.12	1	16	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	7.9	1	13000	1	23	1	690	1	0.2	1	21	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	3.4	1	10000	1	9.1	1	370	1	0.11	1	12	1
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	14	1	14000	1	30	1	180	1	1.125	1	58.5	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	5.2	1	11000	1	20	1	320	1	0.13	1	15	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	27	1	12000	1	25	1	280	1	0.96	1	38	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	5.6	1	14000	1	57	1	370	1	0.18	1	19	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	6.9	1	18000	1	13	1	410	1	0.3	1	20	1
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	5.3	1	15000	1	130	1	410	1	0.21	1	17	1

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	13	Mean	22052
Maximum	260000	Median	252.5
SD	74936	Std. Error of Mean	21632
Coefficient of Variation	3.398	Skewness	3.464

Normal GOF Test

Shapiro Wilk Test Statistic	0.332	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.525	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	60901	95% Adjusted-CLT UCL (Chen-1995)	80746
		95% Modified-t UCL (Johnson-1978)	64506

Gamma GOF Test

A-D Test Statistic	2.113	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.899	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.416	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.275	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.169	k star (bias corrected MLE)	0.182
Theta hat (MLE)	130604	Theta star (bias corrected MLE)	121038
nu hat (MLE)	4.052	nu star (bias corrected)	4.373
MLE Mean (bias corrected)	22052	MLE Sd (bias corrected)	51664
		Approximate Chi Square Value (0.05)	0.874
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	0.666

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	110303	95% Adjusted Gamma UCL (use when n<50)	144874

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.864	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.186	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.565	Mean of logged Data	5.528
Maximum of Logged Data	12.47	SD of logged Data	2.798

Assuming Lognormal Distribution

95% H-UCL	3693139	90% Chebyshev (MVUE) UCL	16516
95% Chebyshev (MVUE) UCL	21808	97.5% Chebyshev (MVUE) UCL	29154
99% Chebyshev (MVUE) UCL	43583		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.d')

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	57634	95% Jackknife UCL	60901
95% Standard Bootstrap UCL	56235	95% Bootstrap-t UCL	4328608
95% Hall's Bootstrap UCL	2449104	95% Percentile Bootstrap UCL	65256
95% BCA Bootstrap UCL	86868		
90% Chebyshev(Mean, Sd) UCL	86948	95% Chebyshev(Mean, Sd) UCL	116344
97.5% Chebyshev(Mean, Sd) UCL	157144	99% Chebyshev(Mean, Sd) UCL	237288

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL 237288

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	11	Mean	22908
Maximum	270000	Median	369.5
SD	77815	Std. Error of Mean	22463
Coefficient of Variation	3.397	Skewness	3.464

Normal GOF Test

Shapiro Wilk Test Statistic	0.332	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.525	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	63250	95% Adjusted-CLT UCL (Chen-1995)	83858
		95% Modified-t UCL (Johnson-1978)	66993

Gamma GOF Test

A-D Test Statistic	2.068	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.901	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.41	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.275	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.167	k star (bias corrected MLE)	0.181
Theta hat (MLE)	137233	Theta star (bias corrected MLE)	126738
nu hat (MLE)	4.006	nu star (bias corrected)	4.338
MLE Mean (bias corrected)	22908	MLE Sd (bias corrected)	53883
		Approximate Chi Square Value (0.05)	0.86
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	0.654

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	115605	95% Adjusted Gamma UCL (use when n<50)	152057

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.191	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.398	Mean of logged Data	5.507
Maximum of Logged Data	12.51	SD of logged Data	2.873

Assuming Lognormal Distribution

95% H-UCL	6039379	90% Chebyshev (MVUE) UCL	18758
95% Chebyshev (MVUE) UCL	24796	97.5% Chebyshev (MVUE) UCL	33178
99% Chebyshev (MVUE) UCL	49642		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	59857	95% Jackknife UCL	63250
95% Standard Bootstrap UCL	57919	95% Bootstrap-t UCL	4517727
95% Hall's Bootstrap UCL	2168626	95% Percentile Bootstrap UCL	67762
95% BCA Bootstrap UCL	90425		
90% Chebyshev(Mean, Sd) UCL	90298	95% Chebyshev(Mean, Sd) UCL	120824
97.5% Chebyshev(Mean, Sd) UCL	163192	99% Chebyshev(Mean, Sd) UCL	246416

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL 246416

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	14	Mean	28035
Maximum	330000	Median	482
SD	95096	Std. Error of Mean	27452
Coefficient of Variation	3.392	Skewness	3.464

Normal GOF Test

Shapiro Wilk Test Statistic	0.333	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.525	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	77336	95% Adjusted-CLT UCL (Chen-1995)	102520
		95% Modified-t UCL (Johnson-1978)	81911

Gamma GOF Test

A-D Test Statistic	2.075	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.897	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.409	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.274	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.171	k star (bias corrected MLE)	0.184
Theta hat (MLE)	164125	Theta star (bias corrected MLE)	152641
nu hat (MLE)	4.1	nu star (bias corrected)	4.408
MLE Mean (bias corrected)	28035	MLE Sd (bias corrected)	65416
		Approximate Chi Square Value (0.05)	0.889
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	0.678

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	138977	95% Adjusted Gamma UCL (use when n<50)	182267

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.639	Mean of logged Data	5.827
Maximum of Logged Data	12.71	SD of logged Data	2.81

Assuming Lognormal Distribution

95% H-UCL	5421185	90% Chebyshev (MVUE) UCL	22835
95% Chebyshev (MVUE) UCL	30158	97.5% Chebyshev (MVUE) UCL	40322
99% Chebyshev (MVUE) UCL	60288		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	73190	95% Jackknife UCL	77336
95% Standard Bootstrap UCL	72064	95% Bootstrap-t UCL	5358930
95% Hall's Bootstrap UCL	2461024	95% Percentile Bootstrap UCL	82877
95% BCA Bootstrap UCL	110431		
90% Chebyshev(Mean, Sd) UCL	110391	95% Chebyshev(Mean, Sd) UCL	147696
97.5% Chebyshev(Mean, Sd) UCL	199473	99% Chebyshev(Mean, Sd) UCL	301179

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	301179

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
Number of Detects	11	Number of Non-Detects	1
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	7.1	Minimum Non-Detect	0.78
Maximum Detect	130000	Maximum Non-Detect	0.78
Variance Detects	1.530E+9	Percent Non-Detects	8.333%
Mean Detects	12058	SD Detects	39118
Median Detects	340	CV Detects	3.244
Skewness Detects	3.316	Kurtosis Detects	11
Mean of Logged Detects	5.198	SD of Logged Detects	2.769

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.351	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.522	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	11053	KM Standard Error of Mean	10859
KM SD	35865	95% KM (BCA) UCL	32676
95% KM (t) UCL	30554	95% KM (Percentile Bootstrap) UCL	32666
95% KM (z) UCL	28914	95% KM Bootstrap t UCL	1934835
90% KM Chebyshev UCL	43629	95% KM Chebyshev UCL	58384
97.5% KM Chebyshev UCL	78865	99% KM Chebyshev UCL	119095

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.911	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.881	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.421	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.284	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.178	k star (bias corrected MLE)	0.19
Theta hat (MLE)	67606	Theta star (bias corrected MLE)	63356
nu hat (MLE)	3.924	nu star (bias corrected)	4.187
Mean (detects)	12058		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	11053
Maximum	130000	Median	185
SD	37460	CV	3.389
k hat (MLE)	0.155	k star (bias corrected MLE)	0.172
Theta hat (MLE)	71242	Theta star (bias corrected MLE)	64293
nu hat (MLE)	3.723	nu star (bias corrected)	4.126
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (4.13, α)	0.772	Adjusted Chi Square Value (4.13, β)	0.582
95% Gamma Approximate UCL (use when n>=50)	59066	95% Gamma Adjusted UCL (use when n<50)	78406

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	11053	SD (KM)	35865
Variance (KM)	1.286E+9	SE of Mean (KM)	10859
k hat (KM)	0.095	k star (KM)	0.127
nu hat (KM)	2.279	nu star (KM)	3.043
theta hat (KM)	116375	theta star (KM)	87176
80% gamma percentile (KM)	10292	90% gamma percentile (KM)	31761
95% gamma percentile (KM)	62602	99% gamma percentile (KM)	155483

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.04, α)	0.385	Adjusted Chi Square Value (3.04, β)	0.277
95% Gamma Approximate KM-UCL (use when n>=50)	87303	95% Gamma Adjusted KM-UCL (use when n<50)	121427

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.863	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	11053	Mean in Log Scale	4.663
SD in Original Scale	37460	SD in Log Scale	3.225
95% t UCL (assumes normality of ROS data)	30473	95% Percentile Bootstrap UCL	32648
95% BCA Bootstrap UCL	43482	95% Bootstrap t UCL	1956827
95% H-UCL (Log ROS)	34406851		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.744	KM Geo Mean	114.9
KM SD (logged)	2.942	95% Critical H Value (KM-Log)	7.06
KM Standard Error of Mean (logged)	0.891	95% H-UCL (KM -Log)	4575694
KM SD (logged)	2.942	95% Critical H Value (KM-Log)	7.06
KM Standard Error of Mean (logged)	0.891		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	11053	Mean in Log Scale	4.686
SD in Original Scale	37460	SD in Log Scale	3.18
95% t UCL (Assumes normality)	30473	95% H-Stat UCL	24869904

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	119095

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
Number of Detects	3	Number of Non-Detects	9
Number of Distinct Detects	3	Number of Distinct Non-Detects	7
Minimum Detect	130	Minimum Non-Detect	21
Maximum Detect	92000	Maximum Non-Detect	200
Variance Detects	2.812E+9	Percent Non-Detects	75%
Mean Detects	30763	SD Detects	53033
Median Detects	160	CV Detects	1.724
Skewness Detects	1.732	Kurtosis Detects	N/A
Mean of Logged Detects	7.124	SD of Logged Detects	3.73

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7709	KM Standard Error of Mean	8986
KM SD	25415	95% KM (BCA) UCL	N/A
95% KM (t) UCL	23846	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	22488	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	34665	95% KM Chebyshev UCL	46876
97.5% KM Chebyshev UCL	63823	99% KM Chebyshev UCL	97113

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.225	k star (bias corrected MLE)	N/A
Theta hat (MLE)	136704	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1.35	nu star (bias corrected)	N/A
Mean (detects)	30763		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	7691
Maximum	92000	Median	0.01
SD	26551	CV	3.452
k hat (MLE)	0.0787	k star (bias corrected MLE)	0.115
Theta hat (MLE)	97736	Theta star (bias corrected MLE)	67126
nu hat (MLE)	1.889	nu star (bias corrected)	2.75
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (2.75, α)	0.302	Adjusted Chi Square Value (2.75, β)	0.217
95% Gamma Approximate UCL (use when n>=50)	69954	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.d')

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7709	SD (KM)	25415
Variance (KM)	6.459E+8	SE of Mean (KM)	8986
k hat (KM)	0.092	k star (KM)	0.125
nu hat (KM)	2.208	nu star (KM)	2.989
theta hat (KM)	83791	theta star (KM)	61890
80% gamma percentile (KM)	7044	90% gamma percentile (KM)	22055
95% gamma percentile (KM)	43771	99% gamma percentile (KM)	109449

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (2.99, α)	0.369	Adjusted Chi Square Value (2.99, β)	0.265
95% Gamma Approximate KM-UCL (use when n>=50)	62405	95% Gamma Adjusted KM-UCL (use when n<50)	86918

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.774	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.375	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	7691	Mean in Log Scale	-1.703
SD in Original Scale	26551	SD in Log Scale	5.791
95% t UCL (assumes normality of ROS data)	21455	95% Percentile Bootstrap UCL	23013
95% BCA Bootstrap UCL	30678	95% Bootstrap t UCL	5442452
95% H-UCL (Log ROS)	7.121E+16		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.097	KM Geo Mean	60.13
KM SD (logged)	2.331	95% Critical H Value (KM-Log)	5.69
KM Standard Error of Mean (logged)	0.828	95% H-UCL (KM -Log)	49707
KM SD (logged)	2.331	95% Critical H Value (KM-Log)	5.69
KM Standard Error of Mean (logged)	0.828		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7712	Mean in Log Scale	4.021
SD in Original Scale	26544	SD in Log Scale	2.555
95% t UCL (Assumes normality)	21473	95% H-Stat UCL	171994

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	23846

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	13	Mean	21242
Maximum	250000	Median	338.5
SD	72042	Std. Error of Mean	20797
Coefficient of Variation	3.391	Skewness	3.464

Normal GOF Test

Shapiro Wilk Test Statistic	0.333	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.525	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	58590	95% Adjusted-CLT UCL (Chen-1995)	77669
		95% Modified-t UCL (Johnson-1978)	62056

Gamma GOF Test

A-D Test Statistic	2.095	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.895	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.42	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.274	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.173	k star (bias corrected MLE)	0.186
Theta hat (MLE)	122566	Theta star (bias corrected MLE)	114488
nu hat (MLE)	4.159	nu star (bias corrected)	4.453
MLE Mean (bias corrected)	21242	MLE Sd (bias corrected)	49315
		Approximate Chi Square Value (0.05)	0.908
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	0.694

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	104131	95% Adjusted Gamma UCL (use when n<50)	136314

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.565	Mean of logged Data	5.623
Maximum of Logged Data	12.43	SD of logged Data	2.755

Assuming Lognormal Distribution

95% H-UCL	3047524	90% Chebyshev (MVUE) UCL	16693
95% Chebyshev (MVUE) UCL	22027	97.5% Chebyshev (MVUE) UCL	29431
99% Chebyshev (MVUE) UCL	43974		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	55450	95% Jackknife UCL	58590
95% Standard Bootstrap UCL	53912	95% Bootstrap-t UCL	3816169
95% Hall's Bootstrap UCL	1966563	95% Percentile Bootstrap UCL	62775
95% BCA Bootstrap UCL	83732		
90% Chebyshev(Mean, Sd) UCL	83632	95% Chebyshev(Mean, Sd) UCL	111893
97.5% Chebyshev(Mean, Sd) UCL	151117	99% Chebyshev(Mean, Sd) UCL	228166

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL 228166

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
Number of Detects	7	Number of Non-Detects	5
Number of Distinct Detects	7	Number of Distinct Non-Detects	5
Minimum Detect	9.3	Minimum Non-Detect	0.74
Maximum Detect	39000	Maximum Non-Detect	7
Variance Detects	2.161E+8	Percent Non-Detects	41.67%
Mean Detects	5666	SD Detects	14699
Median Detects	130	CV Detects	2.594
Skewness Detects	2.646	Kurtosis Detects	6.999
Mean of Logged Detects	5.056	SD of Logged Detects	2.751

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.458	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.501	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3305	KM Standard Error of Mean	3356
KM SD	10763	95% KM (BCA) UCL	9804
95% KM (t) UCL	9332	95% KM (Percentile Bootstrap) UCL	9793
95% KM (z) UCL	8825	95% KM Bootstrap t UCL	577729
90% KM Chebyshev UCL	13373	95% KM Chebyshev UCL	17933
97.5% KM Chebyshev UCL	24263	99% KM Chebyshev UCL	36696

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.227	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.821	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.448	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.342	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.204	k star (bias corrected MLE)	0.212
Theta hat (MLE)	27709	Theta star (bias corrected MLE)	26715
nu hat (MLE)	2.863	nu star (bias corrected)	2.969
Mean (detects)	5666		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3305
Maximum	39000	Median	10.65
SD	11241	CV	3.401
k hat (MLE)	0.113	k star (bias corrected MLE)	0.14
Theta hat (MLE)	29243	Theta star (bias corrected MLE)	23554
nu hat (MLE)	2.713	nu star (bias corrected)	3.368
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (3.37, α)	0.489	Adjusted Chi Square Value (3.37, β)	0.356
95% Gamma Approximate UCL (use when n>=50)	22752	95% Gamma Adjusted UCL (use when n<50)	31265

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3305	SD (KM)	10763
Variance (KM)	1.158E+8	SE of Mean (KM)	3356
k hat (KM)	0.0943	k star (KM)	0.126
nu hat (KM)	2.264	nu star (KM)	3.031
theta hat (KM)	35044	theta star (KM)	26172
80% gamma percentile (KM)	3065	90% gamma percentile (KM)	9489
95% gamma percentile (KM)	18732	99% gamma percentile (KM)	46592

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.03, α)	0.382	Adjusted Chi Square Value (3.03, β)	0.274
95% Gamma Approximate KM-UCL (use when n>=50)	26249	95% Gamma Adjusted KM-UCL (use when n<50)	36520

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.302	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3305	Mean in Log Scale	2.14
SD in Original Scale	11241	SD in Log Scale	4.136
95% t UCL (assumes normality of ROS data)	9133	95% Percentile Bootstrap UCL	9792
95% BCA Bootstrap UCL	13043	95% Bootstrap t UCL	572548
95% H-UCL (Log ROS)	8.782E+9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.824	KM Geo Mean	16.84
KM SD (logged)	3.28	95% Critical H Value (KM-Log)	7.826
KM Standard Error of Mean (logged)	1.023	95% H-UCL (KM -Log)	8394345
KM SD (logged)	3.28	95% Critical H Value (KM-Log)	7.826
KM Standard Error of Mean (logged)	1.023		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3306	Mean in Log Scale	2.776
SD in Original Scale	11241	SD in Log Scale	3.521
95% t UCL (Assumes normality)	9133	95% H-Stat UCL	57188668

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	36696

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
Number of Detects	5	Number of Non-Detects	7
Number of Distinct Detects	5	Number of Distinct Non-Detects	6
Minimum Detect	16	Minimum Non-Detect	15
Maximum Detect	30000	Maximum Non-Detect	140
Variance Detects	1.792E+8	Percent Non-Detects	58.33%
Mean Detects	6051	SD Detects	13388
Median Detects	72	CV Detects	2.213
Skewness Detects	2.236	Kurtosis Detects	5
Mean of Logged Detects	5.234	SD of Logged Detects	2.923

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.554	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.472	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2532	KM Standard Error of Mean	2673
KM SD	8282	95% KM (BCA) UCL	7529
95% KM (t) UCL	7332	95% KM (Percentile Bootstrap) UCL	7525
95% KM (z) UCL	6928	95% KM Bootstrap t UCL	775735
90% KM Chebyshev UCL	10551	95% KM Chebyshev UCL	14183
97.5% KM Chebyshev UCL	19225	99% KM Chebyshev UCL	29128

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.996	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.772	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.468	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.387	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.21	k star (bias corrected MLE)	0.217
Theta hat (MLE)	28790	Theta star (bias corrected MLE)	27833
nu hat (MLE)	2.102	nu star (bias corrected)	2.174
Mean (detects)	6051		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2521
Maximum	30000	Median	0.01
SD	8654	CV	3.432
k hat (MLE)	0.0977	k star (bias corrected MLE)	0.129
Theta hat (MLE)	25810	Theta star (bias corrected MLE)	19572
nu hat (MLE)	2.344	nu star (bias corrected)	3.092
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (3.09, α)	0.4	Adjusted Chi Square Value (3.09, β)	0.288
95% Gamma Approximate UCL (use when n>=50)	19483	95% Gamma Adjusted UCL (use when n<50)	27059

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2532	SD (KM)	8282
Variance (KM)	68592210	SE of Mean (KM)	2673
k hat (KM)	0.0934	k star (KM)	0.126
nu hat (KM)	2.243	nu star (KM)	3.015
theta hat (KM)	27093	theta star (KM)	20151
80% gamma percentile (KM)	2335	90% gamma percentile (KM)	7259
95% gamma percentile (KM)	14358	99% gamma percentile (KM)	35784

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.02, α)	0.377	Adjusted Chi Square Value (3.02, β)	0.271
95% Gamma Approximate KM-UCL (use when n>=50)	20250	95% Gamma Adjusted KM-UCL (use when n<50)	28187

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.762	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2522	Mean in Log Scale	1.721
SD in Original Scale	8653	SD in Log Scale	3.688
95% t UCL (assumes normality of ROS data)	7008	95% Percentile Bootstrap UCL	7515
95% BCA Bootstrap UCL	10017	95% Bootstrap t UCL	827701
95% H-UCL (Log ROS)	85088603		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.81	KM Geo Mean	45.16
KM SD (logged)	2.088	95% Critical H Value (KM-Log)	5.155
KM Standard Error of Mean (logged)	0.678	95% H-UCL (KM -Log)	10270
KM SD (logged)	2.088	95% Critical H Value (KM-Log)	5.155
KM Standard Error of Mean (logged)	0.678		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2535	Mean in Log Scale	3.809
SD in Original Scale	8649	SD in Log Scale	2.258
95% t UCL (Assumes normality)	7019	95% H-Stat UCL	24913

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	29128

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	19	Mean	49992
Maximum	590000	Median	455
SD	170062	Std. Error of Mean	49093
Coefficient of Variation	3.402	Skewness	3.464

Normal GOF Test

Shapiro Wilk Test Statistic	0.332	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.526	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	138157	95% Adjusted-CLT UCL (Chen-1995)	183195
		95% Modified-t UCL (Johnson-1978)	146338

Gamma GOF Test

A-D Test Statistic	2.097	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.902	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.417	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.275	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.165	k star (bias corrected MLE)	0.179
Theta hat (MLE)	303332	Theta star (bias corrected MLE)	279032
nu hat (MLE)	3.955	nu star (bias corrected)	4.3
MLE Mean (bias corrected)	49992	MLE Sd (bias corrected)	118108
		Approximate Chi Square Value (0.05)	0.844
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	0.64

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	254803	95% Adjusted Gamma UCL (use when n<50)	335687

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.873	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.944	Mean of logged Data	6.22
Maximum of Logged Data	13.29	SD of logged Data	2.861

Assuming Lognormal Distribution

95% H-UCL	11388874	90% Chebyshev (MVUE) UCL	37422
95% Chebyshev (MVUE) UCL	49462	97.5% Chebyshev (MVUE) UCL	66172
99% Chebyshev (MVUE) UCL	98996		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	130742	95% Jackknife UCL	138157
95% Standard Bootstrap UCL	128543	95% Bootstrap-t UCL	9878443
95% Hall's Bootstrap UCL	6122895	95% Percentile Bootstrap UCL	148165
95% BCA Bootstrap UCL	197287		
90% Chebyshev(Mean, Sd) UCL	197270	95% Chebyshev(Mean, Sd) UCL	263982
97.5% Chebyshev(Mean, Sd) UCL	356575	99% Chebyshev(Mean, Sd) UCL	538457

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL 538457

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
Number of Detects	11	Number of Non-Detects	1
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	7	Minimum Non-Detect	0.4
Maximum Detect	120000	Maximum Non-Detect	0.4
Variance Detects	1.303E+9	Percent Non-Detects	8.333%
Mean Detects	11147	SD Detects	36103
Median Detects	350	CV Detects	3.239
Skewness Detects	3.316	Kurtosis Detects	11
Mean of Logged Detects	5.183	SD of Logged Detects	2.76

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.351	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.522	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	10218	KM Standard Error of Mean	10022
KM SD	33101	95% KM (BCA) UCL	30199
95% KM (t) UCL	28217	95% KM (Percentile Bootstrap) UCL	30172
95% KM (z) UCL	26703	95% KM Bootstrap t UCL	1626938
90% KM Chebyshev UCL	40284	95% KM Chebyshev UCL	53903
97.5% KM Chebyshev UCL	72805	99% KM Chebyshev UCL	109935

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.872	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.879	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.42	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.283	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.181	k star (bias corrected MLE)	0.192
Theta hat (MLE)	61675	Theta star (bias corrected MLE)	58042
nu hat (MLE)	3.976	nu star (bias corrected)	4.225
Mean (detects)	11147		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	10218
Maximum	120000	Median	191
SD	34573	CV	3.383
k hat (MLE)	0.157	k star (bias corrected MLE)	0.173
Theta hat (MLE)	65104	Theta star (bias corrected MLE)	58973
nu hat (MLE)	3.767	nu star (bias corrected)	4.158
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (4.16, α)	0.785	Adjusted Chi Square Value (4.16, β)	0.592
95% Gamma Approximate UCL (use when n>=50)	54110	95% Gamma Adjusted UCL (use when n<50)	71724

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	10218	SD (KM)	33101
Variance (KM)	1.096E+9	SE of Mean (KM)	10022
k hat (KM)	0.0953	k star (KM)	0.127
nu hat (KM)	2.287	nu star (KM)	3.049
theta hat (KM)	107229	theta star (KM)	80443
80% gamma percentile (KM)	9533	90% gamma percentile (KM)	29376
95% gamma percentile (KM)	57859	99% gamma percentile (KM)	143602

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.05, α)	0.387	Adjusted Chi Square Value (3.05, β)	0.278
95% Gamma Approximate KM-UCL (use when n>=50)	80502	95% Gamma Adjusted KM-UCL (use when n<50)	111950

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.871	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	10218	Mean in Log Scale	4.648
SD in Original Scale	34573	SD in Log Scale	3.219
95% t UCL (assumes normality of ROS data)	28142	95% Percentile Bootstrap UCL	30125
95% BCA Bootstrap UCL	40190	95% Bootstrap t UCL	1630221
95% H-UCL (Log ROS)	32252951		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.675	KM Geo Mean	107.2
KM SD (logged)	3.031	95% Critical H Value (KM-Log)	7.262
KM Standard Error of Mean (logged)	0.918	95% H-UCL (KM -Log)	8089756
KM SD (logged)	3.031	95% Critical H Value (KM-Log)	7.262
KM Standard Error of Mean (logged)	0.918		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	10218	Mean in Log Scale	4.617
SD in Original Scale	34573	SD in Log Scale	3.282
95% t UCL (Assumes normality)	28142	95% H-Stat UCL	51006212

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	109935

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
Number of Detects	10	Number of Non-Detects	2
Number of Distinct Detects	9	Number of Distinct Non-Detects	2
Minimum Detect	8	Minimum Non-Detect	0.92
Maximum Detect	18000	Maximum Non-Detect	8.7
Variance Detects	32213269	Percent Non-Detects	16.67%
Mean Detects	1847	SD Detects	5676
Median Detects	34.5	CV Detects	3.072
Skewness Detects	3.162	Kurtosis Detects	9.998
Mean of Logged Detects	4.104	SD of Logged Detects	2.247

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.373	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.518	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1540	KM Standard Error of Mean	1510
KM SD	4963	95% KM (BCA) UCL	4539
95% KM (t) UCL	4252	95% KM (Percentile Bootstrap) UCL	4529
95% KM (z) UCL	4024	95% KM Bootstrap t UCL	216305
90% KM Chebyshev UCL	6071	95% KM Chebyshev UCL	8123
97.5% KM Chebyshev UCL	10971	99% KM Chebyshev UCL	16566

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.061	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.85	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.441	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.294	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.213	k star (bias corrected MLE)	0.216
Theta hat (MLE)	8666	Theta star (bias corrected MLE)	8557
nu hat (MLE)	4.263	nu star (bias corrected)	4.318
Mean (detects)	1847		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1539
Maximum	18000	Median	21
SD	5184	CV	3.367
k hat (MLE)	0.162	k star (bias corrected MLE)	0.177
Theta hat (MLE)	9496	Theta star (bias corrected MLE)	8690
nu hat (MLE)	3.891	nu star (bias corrected)	4.251
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (4.25, α)	0.823	Adjusted Chi Square Value (4.25, β)	0.624
95% Gamma Approximate UCL (use when n>=50)	7948	95% Gamma Adjusted UCL (use when n<50)	10492

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1540	SD (KM)	4963
Variance (KM)	24632560	SE of Mean (KM)	1510
k hat (KM)	0.0963	k star (KM)	0.128
nu hat (KM)	2.31	nu star (KM)	3.066
theta hat (KM)	15996	theta star (KM)	12053
80% gamma percentile (KM)	1445	90% gamma percentile (KM)	4433
95% gamma percentile (KM)	8712	99% gamma percentile (KM)	21576

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.07, α)	0.392	Adjusted Chi Square Value (3.07, β)	0.282
95% Gamma Approximate KM-UCL (use when n>=50)	12036	95% Gamma Adjusted KM-UCL (use when n<50)	16729

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.783	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.243	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1540	Mean in Log Scale	3.36
SD in Original Scale	5184	SD in Log Scale	2.683
95% t UCL (assumes normality of ROS data)	4227	95% Percentile Bootstrap UCL	4527
95% BCA Bootstrap UCL	6036	95% Bootstrap t UCL	222274
95% H-UCL (Log ROS)	198354		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.496	KM Geo Mean	32.98
KM SD (logged)	2.404	95% Critical H Value (KM-Log)	5.853
KM Standard Error of Mean (logged)	0.741	95% H-UCL (KM -Log)	41322
KM SD (logged)	2.404	95% Critical H Value (KM-Log)	5.853
KM Standard Error of Mean (logged)	0.741		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1540	Mean in Log Scale	3.478
SD in Original Scale	5184	SD in Log Scale	2.55
95% t UCL (Assumes normality)	4227	95% H-Stat UCL	96398

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	16566

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	15	Mean	40385
Maximum	480000	Median	285
SD	138444	Std. Error of Mean	39965
Coefficient of Variation	3.428	Skewness	3.464

Normal GOF Test

Shapiro Wilk Test Statistic	0.33	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.526	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	112158	95% Adjusted-CLT UCL (Chen-1995)	148825
		95% Modified-t UCL (Johnson-1978)	118819

Gamma GOF Test

A-D Test Statistic	2.465	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.908	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.423	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.276	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.158	k star (bias corrected MLE)	0.174
Theta hat (MLE)	254916	Theta star (bias corrected MLE)	231600
nu hat (MLE)	3.802	nu star (bias corrected)	4.185
MLE Mean (bias corrected)	40385	MLE Sd (bias corrected)	96712
		Approximate Chi Square Value (0.05)	0.796
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	0.601

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	212295	95% Adjusted Gamma UCL (use when n<50)	281074

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.708	Mean of logged Data	5.794
Maximum of Logged Data	13.08	SD of logged Data	2.727

Assuming Lognormal Distribution

95% H-UCL	3007983	90% Chebyshev (MVUE) UCL	18748
95% Chebyshev (MVUE) UCL	24728	97.5% Chebyshev (MVUE) UCL	33027
99% Chebyshev (MVUE) UCL	49330		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	106122	95% Jackknife UCL	112158
95% Standard Bootstrap UCL	100518	95% Bootstrap-t UCL	20116019
95% Hall's Bootstrap UCL	9939612	95% Percentile Bootstrap UCL	120220
95% BCA Bootstrap UCL	160430		
90% Chebyshev(Mean, Sd) UCL	160281	95% Chebyshev(Mean, Sd) UCL	214590
97.5% Chebyshev(Mean, Sd) UCL	289968	99% Chebyshev(Mean, Sd) UCL	438035

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	438035

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	20	Mean	38230
Maximum	450000	Median	495
SD	129677	Std. Error of Mean	37435
Coefficient of Variation	3.392	Skewness	3.464

Normal GOF Test

Shapiro Wilk Test Statistic	0.333	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.526	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	105458	95% Adjusted-CLT UCL (Chen-1995)	139800
		95% Modified-t UCL (Johnson-1978)	111697

Gamma GOF Test

A-D Test Statistic	2.082	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.898	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.419	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.274	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.17	k star (bias corrected MLE)	0.183
Theta hat (MLE)	224411	Theta star (bias corrected MLE)	208539
nu hat (MLE)	4.089	nu star (bias corrected)	4.4
MLE Mean (bias corrected)	38230	MLE Sd (bias corrected)	89289
		Approximate Chi Square Value (0.05)	0.886
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	0.675

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	189911	95% Adjusted Gamma UCL (use when n<50)	249150

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.996	Mean of logged Data	6.124
Maximum of Logged Data	13.02	SD of logged Data	2.804

Assuming Lognormal Distribution

95% H-UCL	7001489	90% Chebyshev (MVUE) UCL	30355
95% Chebyshev (MVUE) UCL	40086	97.5% Chebyshev (MVUE) UCL	53592
99% Chebyshev (MVUE) UCL	80124		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	99805	95% Jackknife UCL	105458
95% Standard Bootstrap UCL	97910	95% Bootstrap-t UCL	6539623
95% Hall's Bootstrap UCL	3515931	95% Percentile Bootstrap UCL	113077
95% BCA Bootstrap UCL	150645		
90% Chebyshev(Mean, Sd) UCL	150534	95% Chebyshev(Mean, Sd) UCL	201404
97.5% Chebyshev(Mean, Sd) UCL	272009	99% Chebyshev(Mean, Sd) UCL	410699

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	410699

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	3500	Mean	7117
Maximum	14000	Median	6650
SD	2734	Std. Error of Mean	789.2
Coefficient of Variation	0.384	Skewness	1.47

Normal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8534	95% Adjusted-CLT UCL (Chen-1995)	8773
		95% Modified-t UCL (Johnson-1978)	8590

Gamma GOF Test

A-D Test Statistic	0.263	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.144	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.489	k star (bias corrected MLE)	6.423
Theta hat (MLE)	838.3	Theta star (bias corrected MLE)	1108
nu hat (MLE)	203.7	nu star (bias corrected)	154.1
MLE Mean (bias corrected)	7117	MLE Sd (bias corrected)	2808
		Approximate Chi Square Value (0.05)	126.4
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	122.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8676	95% Adjusted Gamma UCL (use when n<50)	8946

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.126	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.161	Mean of logged Data	8.81
Maximum of Logged Data	9.547	SD of logged Data	0.356

Assuming Lognormal Distribution

95% H-UCL	8835	90% Chebyshev (MVUE) UCL	9321
95% Chebyshev (MVUE) UCL	10326	97.5% Chebyshev (MVUE) UCL	11721
99% Chebyshev (MVUE) UCL	14462		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.d')

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8415	95% Jackknife UCL	8534
95% Standard Bootstrap UCL	8368	95% Bootstrap-t UCL	9166
95% Hall's Bootstrap UCL	15734	95% Percentile Bootstrap UCL	8450
95% BCA Bootstrap UCL	8867		
90% Chebyshev(Mean, Sd) UCL	9484	95% Chebyshev(Mean, Sd) UCL	10557
97.5% Chebyshev(Mean, Sd) UCL	12045	99% Chebyshev(Mean, Sd) UCL	14969

Suggested UCL to Use

95% Student's-t UCL	8534

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
Number of Detects	11	Number of Non-Detects	1
Number of Distinct Detects	10	Number of Distinct Non-Detects	1
Minimum Detect	0.13	Minimum Non-Detect	0.13
Maximum Detect	12	Maximum Non-Detect	0.13
Variance Detects	12.29	Percent Non-Detects	8.333%
Mean Detects	1.47	SD Detects	3.506
Median Detects	0.36	CV Detects	2.385
Skewness Detects	3.27	Kurtosis Detects	10.77
Mean of Logged Detects	-0.817	SD of Logged Detects	1.322

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.42	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.451	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.358	KM Standard Error of Mean	0.975
KM SD	3.222	95% KM (BCA) UCL	3.377
95% KM (t) UCL	3.11	95% KM (Percentile Bootstrap) UCL	3.249
95% KM (z) UCL	2.963	95% KM Bootstrap t UCL	17.31
90% KM Chebyshev UCL	4.285	95% KM Chebyshev UCL	5.61
97.5% KM Chebyshev UCL	7.45	99% KM Chebyshev UCL	11.06

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.56	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.779	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.305	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.269	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.524	k star (bias corrected MLE)	0.442
Theta hat (MLE)	2.803	Theta star (bias corrected MLE)	3.326
nu hat (MLE)	11.54	nu star (bias corrected)	9.725
Mean (detects)	1.47		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.348
Maximum	12	Median	0.295
SD	3.369	CV	2.499
k hat (MLE)	0.451	k star (bias corrected MLE)	0.394
Theta hat (MLE)	2.99	Theta star (bias corrected MLE)	3.424
nu hat (MLE)	10.82	nu star (bias corrected)	9.45
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (9.45, α)	3.601	Adjusted Chi Square Value (9.45, β)	3.071
95% Gamma Approximate UCL (use when n>=50)	3.538	95% Gamma Adjusted UCL (use when n<50)	4.149

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.d')

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.358	SD (KM)	3.222
Variance (KM)	10.38	SE of Mean (KM)	0.975
k hat (KM)	0.178	k star (KM)	0.189
nu hat (KM)	4.266	nu star (KM)	4.533
theta hat (KM)	7.642	theta star (KM)	7.192
80% gamma percentile (KM)	1.734	90% gamma percentile (KM)	4.104
95% gamma percentile (KM)	7.102	99% gamma percentile (KM)	15.43

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.53, α)	0.943	Adjusted Chi Square Value (4.53, β)	0.723
95% Gamma Approximate KM-UCL (use when n>=50)	6.531	95% Gamma Adjusted KM-UCL (use when n<50)	8.522

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.349	Mean in Log Scale	-1.069
SD in Original Scale	3.369	SD in Log Scale	1.534
95% t UCL (assumes normality of ROS data)	3.096	95% Percentile Bootstrap UCL	3.258
95% BCA Bootstrap UCL	4.278	95% Bootstrap t UCL	17.34
95% H-UCL (Log ROS)	6.967		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.919	KM Geo Mean	0.399
KM SD (logged)	1.253	95% Critical H Value (KM-Log)	3.395
KM Standard Error of Mean (logged)	0.379	95% H-UCL (KM -Log)	3.154
KM SD (logged)	1.253	95% Critical H Value (KM-Log)	3.395
KM Standard Error of Mean (logged)	0.379		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.353	Mean in Log Scale	-0.977
SD in Original Scale	3.367	SD in Log Scale	1.376
95% t UCL (Assumes normality)	3.099	95% H-Stat UCL	4.399

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	5.61

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	1.8	Mean	12.63
Maximum	50	Median	7.35
SD	13.96	Std. Error of Mean	4.029
Coefficient of Variation	1.105	Skewness	2.275

Normal GOF Test

Shapiro Wilk Test Statistic	0.631	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.408	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19.87	95% Adjusted-CLT UCL (Chen-1995)	22.09
		95% Modified-t UCL (Johnson-1978)	20.31

Gamma GOF Test

A-D Test Statistic	1.256	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.746	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.331	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.25	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.488	k star (bias corrected MLE)	1.172
Theta hat (MLE)	8.488	Theta star (bias corrected MLE)	10.78
nu hat (MLE)	35.72	nu star (bias corrected)	28.12
MLE Mean (bias corrected)	12.63	MLE Sd (bias corrected)	11.67
		Approximate Chi Square Value (0.05)	17.02
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	15.72

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	20.87	95% Adjusted Gamma UCL (use when n<50)	22.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.588	Mean of logged Data	2.164
Maximum of Logged Data	3.912	SD of logged Data	0.843

Assuming Lognormal Distribution

95% H-UCL	24.29	90% Chebyshev (MVUE) UCL	21.18
95% Chebyshev (MVUE) UCL	25.35	97.5% Chebyshev (MVUE) UCL	31.15
99% Chebyshev (MVUE) UCL	42.52		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	19.26	95% Jackknife UCL	19.87
95% Standard Bootstrap UCL	18.93	95% Bootstrap-t UCL	50.53
95% Hall's Bootstrap UCL	68.83	95% Percentile Bootstrap UCL	19.76
95% BCA Bootstrap UCL	22.01		
90% Chebyshev(Mean, Sd) UCL	24.72	95% Chebyshev(Mean, Sd) UCL	30.19
97.5% Chebyshev(Mean, Sd) UCL	37.79	99% Chebyshev(Mean, Sd) UCL	52.72

Suggested UCL to Use

95% H-UCL	24.29

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	6	Number of Non-Detects	6
Number of Distinct Detects	5	Number of Distinct Non-Detects	4
Minimum Detect	0.51	Minimum Non-Detect	0.26
Maximum Detect	1.2	Maximum Non-Detect	1.4
Variance Detects	0.0659	Percent Non-Detects	50%
Mean Detects	0.737	SD Detects	0.257
Median Detects	0.66	CV Detects	0.348
Skewness Detects	1.433	Kurtosis Detects	1.891
Mean of Logged Detects	-0.35	SD of Logged Detects	0.317

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.855	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.52	KM Standard Error of Mean	0.097
KM SD	0.294	95% KM (BCA) UCL	0.684
95% KM (t) UCL	0.694	95% KM (Percentile Bootstrap) UCL	0.67
95% KM (z) UCL	0.68	95% KM Bootstrap t UCL	0.685
90% KM Chebyshev UCL	0.811	95% KM Chebyshev UCL	0.943
97.5% KM Chebyshev UCL	1.126	99% KM Chebyshev UCL	1.485

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.389	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.271	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	11.4	k star (bias corrected MLE)	5.81
Theta hat (MLE)	0.0646	Theta star (bias corrected MLE)	0.127
nu hat (MLE)	136.8	nu star (bias corrected)	69.72
Mean (detects)	0.737		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0119	Mean	0.448
Maximum	1.2	Median	0.463
SD	0.362	CV	0.808
k hat (MLE)	0.923	k star (bias corrected MLE)	0.748
Theta hat (MLE)	0.486	Theta star (bias corrected MLE)	0.6
nu hat (MLE)	22.15	nu star (bias corrected)	17.94
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (17.94, α)	9.35	Adjusted Chi Square Value (17.94, β)	8.418
95% Gamma Approximate UCL (use when n>=50)	0.86	95% Gamma Adjusted UCL (use when n<50)	0.955

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.52	SD (KM)	0.294
Variance (KM)	0.0863	SE of Mean (KM)	0.097
k hat (KM)	3.134	k star (KM)	2.406
nu hat (KM)	75.22	nu star (KM)	57.75
theta hat (KM)	0.166	theta star (KM)	0.216
80% gamma percentile (KM)	0.762	90% gamma percentile (KM)	0.969
95% gamma percentile (KM)	1.165	99% gamma percentile (KM)	1.594

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (57.75, α)	41.28	Adjusted Chi Square Value (57.75, β)	39.16
95% Gamma Approximate KM-UCL (use when n>=50)	0.727	95% Gamma Adjusted KM-UCL (use when n<50)	0.767

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.248	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.527	Mean in Log Scale	-0.763
SD in Original Scale	0.285	SD in Log Scale	0.509
95% t UCL (assumes normality of ROS data)	0.674	95% Percentile Bootstrap UCL	0.661
95% BCA Bootstrap UCL	0.683	95% Bootstrap t UCL	0.73
95% H-UCL (Log ROS)	0.738		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.803	KM Geo Mean	0.448
KM SD (logged)	0.54	95% Critical H Value (KM-Log)	2.192
KM Standard Error of Mean (logged)	0.179	95% H-UCL (KM -Log)	0.741
KM SD (logged)	0.54	95% Critical H Value (KM-Log)	2.192
KM Standard Error of Mean (logged)	0.179		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.483	Mean in Log Scale	-1.036
SD in Original Scale	0.352	SD in Log Scale	0.874
95% t UCL (Assumes normality)	0.666	95% H-Stat UCL	1.056

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.694

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	1.2	Mean	7.625
Maximum	27	Median	5.3
SD	6.823	Std. Error of Mean	1.97
Coefficient of Variation	0.895	Skewness	2.438

Normal GOF Test

Shapiro Wilk Test Statistic	0.686	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.317	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	11.16	95% Adjusted-CLT UCL (Chen-1995)	12.35
		95% Modified-t UCL (Johnson-1978)	11.39

Gamma GOF Test

A-D Test Statistic	0.848	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.741	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.249	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.04	k star (bias corrected MLE)	1.586
Theta hat (MLE)	3.737	Theta star (bias corrected MLE)	4.808
nu hat (MLE)	48.97	nu star (bias corrected)	38.06
MLE Mean (bias corrected)	7.625	MLE Sd (bias corrected)	6.055
		Approximate Chi Square Value (0.05)	24.93
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	23.32

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	11.64	95% Adjusted Gamma UCL (use when n<50)	12.44

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.182	Mean of logged Data	1.767
Maximum of Logged Data	3.296	SD of logged Data	0.747

Assuming Lognormal Distribution

95% H-UCL	13.53	90% Chebyshev (MVUE) UCL	12.61
95% Chebyshev (MVUE) UCL	14.91	97.5% Chebyshev (MVUE) UCL	18.11
99% Chebyshev (MVUE) UCL	24.4		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	10.86	95% Jackknife UCL	11.16
95% Standard Bootstrap UCL	10.75	95% Bootstrap-t UCL	18.54
95% Hall's Bootstrap UCL	29.26	95% Percentile Bootstrap UCL	11.07
95% BCA Bootstrap UCL	12.33		
90% Chebyshev(Mean, Sd) UCL	13.53	95% Chebyshev(Mean, Sd) UCL	16.21
97.5% Chebyshev(Mean, Sd) UCL	19.93	99% Chebyshev(Mean, Sd) UCL	27.22

Suggested UCL to Use

95% Adjusted Gamma UCL	12.44

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	10000	Mean	17583
Maximum	54000	Median	14000
SD	11897	Std. Error of Mean	3434
Coefficient of Variation	0.677	Skewness	3.057

Normal GOF Test

Shapiro Wilk Test Statistic	0.558	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	23751	95% Adjusted-CLT UCL (Chen-1995)	26471
		95% Modified-t UCL (Johnson-1978)	24256

Gamma GOF Test

A-D Test Statistic	1.534	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.734	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.315	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.39	k star (bias corrected MLE)	3.348
Theta hat (MLE)	4005	Theta star (bias corrected MLE)	5252
nu hat (MLE)	105.4	nu star (bias corrected)	80.35
MLE Mean (bias corrected)	17583	MLE Sd (bias corrected)	9610
		Approximate Chi Square Value (0.05)	60.7
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	58.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	23277	95% Adjusted Gamma UCL (use when n<50)	24319

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.752	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.287	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.21	Mean of logged Data	9.657
Maximum of Logged Data	10.9	SD of logged Data	0.442

Assuming Lognormal Distribution

95% H-UCL	22711	90% Chebyshev (MVUE) UCL	23741
95% Chebyshev (MVUE) UCL	26760	97.5% Chebyshev (MVUE) UCL	30949
99% Chebyshev (MVUE) UCL	39178		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	23232	95% Jackknife UCL	23751
95% Standard Bootstrap UCL	23053	95% Bootstrap-t UCL	41818
95% Hall's Bootstrap UCL	46932	95% Percentile Bootstrap UCL	23917
95% BCA Bootstrap UCL	27500		
90% Chebyshev(Mean, Sd) UCL	27886	95% Chebyshev(Mean, Sd) UCL	32553
97.5% Chebyshev(Mean, Sd) UCL	39031	99% Chebyshev(Mean, Sd) UCL	51755

Suggested UCL to Use

95% Student's-t UCL	23751	or 95% Modified-t UCL	24256

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	9.1	Mean	116.3
Maximum	1000	Median	25.5
SD	280.2	Std. Error of Mean	80.89
Coefficient of Variation	2.409	Skewness	3.383

Normal GOF Test

Shapiro Wilk Test Statistic	0.412	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.417	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	261.6	95% Adjusted-CLT UCL (Chen-1995)	333.8
		95% Modified-t UCL (Johnson-1978)	274.8

Gamma GOF Test

A-D Test Statistic	1.792	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.782	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.331	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.258	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.54	k star (bias corrected MLE)	0.461
Theta hat (MLE)	215.4	Theta star (bias corrected MLE)	252.6
nu hat (MLE)	12.96	nu star (bias corrected)	11.05
MLE Mean (bias corrected)	116.3	MLE Sd (bias corrected)	171.4
		Approximate Chi Square Value (0.05)	4.611
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	3.996

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	278.9	95% Adjusted Gamma UCL (use when n<50)	321.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.208	Mean of logged Data	3.594
Maximum of Logged Data	6.908	SD of logged Data	1.266

Assuming Lognormal Distribution

95% H-UCL	299.7	90% Chebyshev (MVUE) UCL	160.4
95% Chebyshev (MVUE) UCL	199.9	97.5% Chebyshev (MVUE) UCL	254.8
99% Chebyshev (MVUE) UCL	362.5		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.d')

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	249.4	95% Jackknife UCL	261.6
95% Standard Bootstrap UCL	243.8	95% Bootstrap-t UCL	1973
95% Hall's Bootstrap UCL	944.5	95% Percentile Bootstrap UCL	273.1
95% BCA Bootstrap UCL	358.7		
90% Chebyshev(Mean, Sd) UCL	359	95% Chebyshev(Mean, Sd) UCL	468.9
97.5% Chebyshev(Mean, Sd) UCL	621.5	99% Chebyshev(Mean, Sd) UCL	921.2

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	468.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	180	Mean	865.8
Maximum	6000	Median	390
SD	1622	Std. Error of Mean	468.3
Coefficient of Variation	1.873	Skewness	3.424

Normal GOF Test

Shapiro Wilk Test Statistic	0.398	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.46	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1707	95% Adjusted-CLT UCL (Chen-1995)	2131
		95% Modified-t UCL (Johnson-1978)	1784

Gamma GOF Test

A-D Test Statistic	2.407	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.758	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.367	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.253	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.969	k star (bias corrected MLE)	0.782
Theta hat (MLE)	893.8	Theta star (bias corrected MLE)	1107
nu hat (MLE)	23.25	nu star (bias corrected)	18.77
MLE Mean (bias corrected)	865.8	MLE Sd (bias corrected)	979.1
		Approximate Chi Square Value (0.05)	9.95
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	8.984

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1633	95% Adjusted Gamma UCL (use when n<50)	1809

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.691	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.193	Mean of logged Data	6.166
Maximum of Logged Data	8.7	SD of logged Data	0.865

Assuming Lognormal Distribution

95% H-UCL	1392	90% Chebyshev (MVUE) UCL	1192
95% Chebyshev (MVUE) UCL	1431	97.5% Chebyshev (MVUE) UCL	1763
99% Chebyshev (MVUE) UCL	2414		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	1636	95% Jackknife UCL	1707
95% Standard Bootstrap UCL	1621	95% Bootstrap-t UCL	9879
95% Hall's Bootstrap UCL	6417	95% Percentile Bootstrap UCL	1791
95% BCA Bootstrap UCL	2251		
90% Chebyshev(Mean, Sd) UCL	2271	95% Chebyshev(Mean, Sd) UCL	2907
97.5% Chebyshev(Mean, Sd) UCL	3790	99% Chebyshev(Mean, Sd) UCL	5525

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	2907

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
Number of Detects	11	Number of Non-Detects	1
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	0.11	Minimum Non-Detect	0.046
Maximum Detect	1.125	Maximum Non-Detect	0.046
Variance Detects	0.124	Percent Non-Detects	8.333%
Mean Detects	0.343	SD Detects	0.352
Median Detects	0.2	CV Detects	1.026
Skewness Detects	1.861	Kurtosis Detects	2.126
Mean of Logged Detects	-1.402	SD of Logged Detects	0.775

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.648	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.367	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.318	KM Standard Error of Mean	0.1
KM SD	0.332	95% KM (BCA) UCL	0.494
95% KM (t) UCL	0.499	95% KM (Percentile Bootstrap) UCL	0.493
95% KM (z) UCL	0.484	95% KM Bootstrap t UCL	1.071
90% KM Chebyshev UCL	0.62	95% KM Chebyshev UCL	0.756
97.5% KM Chebyshev UCL	0.946	99% KM Chebyshev UCL	1.318

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.207	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.741	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.28	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.259	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.649	k star (bias corrected MLE)	1.26
Theta hat (MLE)	0.208	Theta star (bias corrected MLE)	0.272
nu hat (MLE)	36.27	nu star (bias corrected)	27.71
Mean (detects)	0.343		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.315
Maximum	1.125	Median	0.195
SD	0.349	CV	1.107
k hat (MLE)	1.107	k star (bias corrected MLE)	0.886
Theta hat (MLE)	0.285	Theta star (bias corrected MLE)	0.356
nu hat (MLE)	26.57	nu star (bias corrected)	21.26
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (21.26, α)	11.78	Adjusted Chi Square Value (21.26, β)	10.72
95% Gamma Approximate UCL (use when n>=50)	0.569	95% Gamma Adjusted UCL (use when n<50)	0.625

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.318	SD (KM)	0.332
Variance (KM)	0.11	SE of Mean (KM)	0.1
k hat (KM)	0.921	k star (KM)	0.746
nu hat (KM)	22.1	nu star (KM)	17.91
theta hat (KM)	0.346	theta star (KM)	0.427
80% gamma percentile (KM)	0.522	90% gamma percentile (KM)	0.787
95% gamma percentile (KM)	1.059	99% gamma percentile (KM)	1.705

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.91, α)	9.326	Adjusted Chi Square Value (17.91, β)	8.395
95% Gamma Approximate KM-UCL (use when n>=50)	0.612	95% Gamma Adjusted KM-UCL (use when n<50)	0.679

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.831	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.318	Mean in Log Scale	-1.552
SD in Original Scale	0.347	SD in Log Scale	0.903
95% t UCL (assumes normality of ROS data)	0.498	95% Percentile Bootstrap UCL	0.488
95% BCA Bootstrap UCL	0.529	95% Bootstrap t UCL	1.06
95% H-UCL (Log ROS)	0.671		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.542	KM Geo Mean	0.214
KM SD (logged)	0.846	95% Critical H Value (KM-Log)	2.645
KM Standard Error of Mean (logged)	0.256	95% H-UCL (KM -Log)	0.601
KM SD (logged)	0.846	95% Critical H Value (KM-Log)	2.645
KM Standard Error of Mean (logged)	0.256		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.317	Mean in Log Scale	-1.6
SD in Original Scale	0.348	SD in Log Scale	1.007
95% t UCL (Assumes normality)	0.497	95% H-Stat UCL	0.815

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.601

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	12	Mean	35.54
Maximum	170	Median	19.5
SD	44.24	Std. Error of Mean	12.77
Coefficient of Variation	1.245	Skewness	3.008

Normal GOF Test

Shapiro Wilk Test Statistic	0.534	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.37	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	58.48	95% Adjusted-CLT UCL (Chen-1995)	68.4
		95% Modified-t UCL (Johnson-1978)	60.33

Gamma GOF Test

A-D Test Statistic	1.599	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.359	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.249	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.56	k star (bias corrected MLE)	1.226
Theta hat (MLE)	22.78	Theta star (bias corrected MLE)	28.99
nu hat (MLE)	37.45	nu star (bias corrected)	29.42
MLE Mean (bias corrected)	35.54	MLE Sd (bias corrected)	32.1
		Approximate Chi Square Value (0.05)	18.04
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	16.69

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	57.97	95% Adjusted Gamma UCL (use when n<50)	62.65

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.78	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.318	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.485	Mean of logged Data	3.217
Maximum of Logged Data	5.136	SD of logged Data	0.739

Assuming Lognormal Distribution

95% H-UCL	56.86	90% Chebyshev (MVUE) UCL	53.24
95% Chebyshev (MVUE) UCL	62.9	97.5% Chebyshev (MVUE) UCL	76.31
99% Chebyshev (MVUE) UCL	102.7		

Table B.5.2

Summary of ProUCL Output for EU03-EU04 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 9:41:58 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	56.55	95% Jackknife UCL	58.48
95% Standard Bootstrap UCL	55.63	95% Bootstrap-t UCL	146.8
95% Hall's Bootstrap UCL	132.2	95% Percentile Bootstrap UCL	58.42
95% BCA Bootstrap UCL	72.13		
90% Chebyshev(Mean, Sd) UCL	73.86	95% Chebyshev(Mean, Sd) UCL	91.21
97.5% Chebyshev(Mean, Sd) UCL	115.3	99% Chebyshev(Mean, Sd) UCL	162.6

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	91.21

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.3

Summary of ProUCL Input Data for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Benzo(k)fluoranthene	D_Benzo(k)fluoranthene	Carbazole	D_Carbazole	Chrysene	D_Chrysene
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	260000	1	270000	1	330000	1	130000	1	92000	1	250000	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	440	1	680	1	960	1	510	1	200	0	580	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	1400	1	1500	1	2000	1	790	1	160	1	1400	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	63	1	59	1	70	1	30	1	21	0	57	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	49	1	43	1	67	1	27	1	22	0	61	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	800	1	730	1	870	1	340	1	81	0	830	1
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	19	1	17.85	1	26.5	1	12	1	31	0	20	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	65	1	55	1	94	1	28	1	21	0	97	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	14	1	12	1	20	1	7.1	1	26	0	17	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	660	1	690	1	1000	1	410	1	87	0	730	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	13	1	11	1	14	1	0.78	0	22	0	13	1
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	1100	1	1100	1	1300	1	480	1	130	1	1100	1
on-site (EU03)	BH152-18	5/29/2018	9-11 ft BGS	5900	1	4800	1	7400	1	2500	1	1800	1	6000	1
on-site (EU03)	BH153-18	5/29/2018	13-15 ft BGS	280	1	270	1	410	1	150	1	72	1	340	1
on-site (EU03)	BH154-18	5/29/2018	13-15 ft BGS	30	1	30	1	47	1	0.74	0	21	0	40	1
on-site (EU03)	BH155-18	5/29/2018	13-15 ft BGS	28	1	23	1	53.5	1	17	1	22	0	35	1
on-site (EU03)	BH156-18	5/16/2018	13-15 ft BGS	57	1	52	1	76	1	32	1	24	0	68	1
on-site (EU03)	BH157-18	5/17/2018	12-14 ft BGS	130	1	120	1	150	1	67	1	20	0	140	1
on-site (EU03)	GP07-18	8/1/2018	12-13 ft bgs												
on-site (EU03)	TT-18	10/1/2008	12 ft BGS									53	0		
on-site (EU03)	TT-18	10/1/2008	12- ft BGS	78	1	73	1	100	1	42	1			80	1
on-site (EU03)	TT-18	10/1/2008	5 ft BGS	9.1	0	9.1	0	9.1	0	9.1	0	68	0	9.1	0
on-site (EU03)	TT-18	10/1/2008	5- ft BGS												
on-site (EU04)	BH146-18	5/17/2018	13-15 ft BGS	13	1	10	1	12	1	1.3	0	36	0	13	1
on-site (EU04)	BH147-18	5/17/2018	12-14 ft BGS	42	1	36	1	55	1	17	1	21	0	47	1
on-site (EU04)	BH148-18	5/17/2018	6-8 ft BGS	0.97	0	0.99	0	0.91	0	1	0	29	0	1.7	0
on-site (EU04)	BH149-18	5/29/2018	10-12 ft BGS	25	1	27	1	33	1	0.78	0	22	0	38	1
on-site (EU04)	BH150-18	5/29/2018	13-15 ft BGS	110	1	120	1	180	1	63	1	24	1	140	1
on-site (EU04)	BH151-18	5/29/2018	10-12 ft BGS	150	1	140	1	200	1	66	1	22	1	180	1
on-site (EU04)	GP08-19	1/15/2019	11.67-12.67 ft BGS												
on-site (EU04)	TT-17	9/30/2008	14 ft BGS												
on-site (EU04)	TT-17	9/30/2008	14- ft BGS	1200	1	990	1	1300	1	600	1	400	1	1400	1
on-site (EU04)	TT-17	9/30/2008	5 ft BGS									55	0		
on-site (EU04)	TT-17	9/30/2008	5- ft BGS	84	1	89	1	120	1	59	1			110	1

Table B.5.3

Summary of ProUCL Input Data for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Dibenzofuran	D_Dibenzofuran	Fluoranthene	D_Fluoranthene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Naphthalene	D_Naphthalene	Phenanthrene	D_Phenanthrene
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	39000	1	30000	1	590000	1	120000	1	18000	1	480000	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	7	0	140	0	800	1	410	1	8.7	0	360	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	230	1	72	1	2700	1	770	1	110	1	940	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	0.74	0	15	0	100	1	30	1	0.92	0	48	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	9.3	1	15	0	110	1	31	1	8	1	80	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	100	1	56	0	1900	1	370	1	21	1	490	1
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	1.1	0	21	0	45.5	1	9.25	1	14.5	1	29.5	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	12	1	67	1	99	1	32	1	150	1	210	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	0.92	0	18	0	33	1	7	1	10	1	15	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	130	1	59	0	1200	1	350	1	21	1	490	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	0.76	0	16	1	19	1	0.4	0	48	1	59	1
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	180	1	100	1	2900	1	610	1	91	1	1900	1
on-site (EU03)	BH152-18	5/29/2018	9-11 ft BGS	670	1	1700	1	15000	1	2300	1	870	1	15000	1
on-site (EU03)	BH153-18	5/29/2018	13-15 ft BGS	1.9	0	37	0	700	1	150	1	2.3	0	510	1
on-site (EU03)	BH154-18	5/29/2018	13-15 ft BGS	0.72	0	14	0	56	1	26	1	19	1	45	1
on-site (EU03)	BH155-18	5/29/2018	13-15 ft BGS	0.77	0	15	0	38.5	1	24	1	5.3	1	16.45	1
on-site (EU03)	BH156-18	5/16/2018	13-15 ft BGS	11	1	17	0	110	1	34	1	19	1	57	1
on-site (EU03)	BH157-18	5/17/2018	12-14 ft BGS	19	1	14	0	250	1	69	1	0.87	0	100	1
on-site (EU03)	GP07-18	8/1/2018	12-13 ft bgs												
on-site (EU03)	TT-18	10/1/2008	12 ft BGS												
on-site (EU03)	TT-18	10/1/2008	12- ft BGS	11	1	84	1	190	1	45	1	46	1	250	1
on-site (EU03)	TT-18	10/1/2008	5 ft BGS	9.1	0	68	0	9.1	0	9.1	0	9.1	0	9.1	0
on-site (EU03)	TT-18	10/1/2008	5- ft BGS					-						-	
on-site (EU04)	BH146-18	5/17/2018	13-15 ft BGS	1.2	0	24	0	24	1	0.66	0	1.5	0	20	1
on-site (EU04)	BH147-18	5/17/2018	12-14 ft BGS	6.2	1	14	0	87	1	19	1	10	1	47	1
on-site (EU04)	BH148-18	5/17/2018	6-8 ft BGS	1	0	20	0	0.85	0	0.54	0	13	1	5.8	1
on-site (EU04)	BH149-18	5/29/2018	10-12 ft BGS	0.76	0	15	0	46	1	0.4	0	24	1	54	1
on-site (EU04)	BH150-18	5/29/2018	13-15 ft BGS	23	1	16	0	280	1	68	1	1	0	150	1
on-site (EU04)	BH151-18	5/29/2018	10-12 ft BGS	28	1	15	0	250	1	94	1	27	1	130	1
on-site (EU04)	GP08-19	1/15/2019	11.67-12.67 ft BGS												
on-site (EU04)	TT-17	9/30/2008	14 ft BGS			180	1								
on-site (EU04)	TT-17	9/30/2008	14- ft BGS	140	1			3700	1	530	1	110	1	3400	1
on-site (EU04)	TT-17	9/30/2008	5 ft BGS			55	0					7.3	0		
on-site (EU04)	TT-17	9/30/2008	5- ft BGS	14	1			230	1	55	1			140	1

Table B.5.3

Summary of ProUCL Input Data for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Pyrene	D_Pyrene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Iron	D_Iron
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	450000	1	5900	1	1.1	1	9.4	1	0.67	1	0.27	0	5.1	1	22000	1
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	890	1	9800	1	0.13	1	1.8	1	0.18	1	0.66	1	1.2	1	54000	1
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	2300	1	5100	1	0.15	1	6	1	0.23	1	0.85	1	5.3	1	14000	1
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	93	1	6200	1	0.13	0	6.1	1	0.26	1	1.4	0	4.6	1	14000	1
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	90	1	7200	1	0.59	1	7	1	0.25	1	0.27	0	7.9	1	13000	1
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	1700	1	3500	1	0.15	1	5.7	1	0.2	1	0.26	0	3.4	1	10000	1
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	41	1	14000	1	0.74	1	32	1	0.25	1	1.2	1	14	1	14000	1
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	100	1	4800	1	0.23	1	7.4	1	0.32	1	0.51	1	5.2	1	11000	1
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	29	1	7500	1	12	1	50	1	0.29	1	0.54	1	27	1	12000	1
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	1100	1	7100	1	0.56	1	7.3	1	0.92	1	0.28	0	5.6	1	14000	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	20	1	8300	1	0.16	1	10	1	0.16	1	0.28	0	6.9	1	18000	1
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	2400	1	6000	1	0.36	1	8.9	1	0.53	1	0.66	1	5.3	1	15000	1
on-site (EU03)	BH152-18	5/29/2018	9-11 ft BGS	11000	1	9600	1	5	1	8.7	1	15	1	0.31	1	6.1	1	15000	1
on-site (EU03)	BH153-18	5/29/2018	13-15 ft BGS	600	1	8700	1	0.16	1	7.6	1	0.22	1	0.27	0	5.5	1	15000	1
on-site (EU03)	BH154-18	5/29/2018	13-15 ft BGS	53	1	3400	1	0.19	1	7.7	1	0.25	1	0.26	0	3.4	1	9800	1
on-site (EU03)	BH155-18	5/29/2018	13-15 ft BGS	33.5	1	9050	1	0.175	1	7.85	1	0.215	1	1	1	5.6	1	16000	1
on-site (EU03)	BH156-18	5/16/2018	13-15 ft BGS	97	1	5800	1	0.23	1	7.5	1	0.25	1	0.31	0	4.5	1	12000	1
on-site (EU03)	BH157-18	5/17/2018	12-14 ft BGS	220	1	1500	1	0.12	0	5.7	1	0.091	1	0.25	0	2.5	1	6300	1
on-site (EU03)	GP07-18	8/1/2018	12-13 ft bgs																
on-site (EU03)	TT-18	10/1/2008	12 ft BGS					6.4	0										
on-site (EU03)	TT-18	10/1/2008	12- ft BGS	160	1	2310	1			2.9	1	0.1	1	0.66	1	2.8	1	6040	1
on-site (EU03)	TT-18	10/1/2008	5 ft BGS	9.1	0							0.68	0						
on-site (EU03)	TT-18	10/1/2008	5- ft BGS			5680	1	0.78	1	17.7	1			1.7	1	4.5	1	9890	1
on-site (EU04)	BH146-18	5/17/2018	13-15 ft BGS	24	1	2400	1	0.2	0	0.74	1	0.07	0	0.86	1	0.77	1	1200	1
on-site (EU04)	BH147-18	5/17/2018	12-14 ft BGS	74	1	2500	1	0.12	0	5	1	0.13	1	0.52	1	2.6	1	6700	1
on-site (EU04)	BH148-18	5/17/2018	6-8 ft BGS	0.68	0	9200	1	1.1	1	56	1	0.21	1	1.2	1	15	1	9900	1
on-site (EU04)	BH149-18	5/29/2018	10-12 ft BGS	47	1	5000	1	0.34	1	15	1	0.15	1	0.85	1	4.3	1	7900	1
on-site (EU04)	BH150-18	5/29/2018	13-15 ft BGS	240	1	10000	1	0.22	1	9	1	0.19	1	1.5	0	7.6	1	19000	1
on-site (EU04)	BH151-18	5/29/2018	10-12 ft BGS	260	1	6700	1	0.24	1	8.6	1	0.26	1	1.4	0	6.5	1	14000	1
on-site (EU04)	GP08-19	1/15/2019	11.67-12.67 ft BGS																
on-site (EU04)	TT-17	9/30/2008	14 ft BGS																
on-site (EU04)	TT-17	9/30/2008	14- ft BGS	2900	1	3180	1	0.65	1	10.9	1	0.11	1	1.2	1	2.6	1	12000	1
on-site (EU04)	TT-17	9/30/2008	5 ft BGS					6.6	0										
on-site (EU04)	TT-17	9/30/2008	5- ft BGS	180	1	6830	1			6.8	1	0.18	1	1.5	1	6.3	1	14200	1

Table B.5.3

Summary of ProUCL Input Data for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				40	41	42	43	44	45	46	47	48	49	50	51
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Lead	D_Lead	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU03)	SS-146	5/29/2018	0-2 ft BGS	1000	1	390	1	0.25	1	18	1	20	0	25	0
on-site (EU03)	SS-147	5/29/2018	0-2 ft BGS	14	1	6000	1	0.046	0	170	1	20	0	24	0
on-site (EU03)	SS-149	5/29/2018	0-2 ft BGS	26	1	580	1	0.19	1	22	1	21	0	25	0
on-site (EU03)	SS-150	5/29/2018	0-2 ft BGS	49	1	390	1	0.12	1	16	1	22	0	27	0
on-site (EU03)	SS-151	5/16/2018	0-2 ft BGS	23	1	690	1	0.2	1	21	1	22	0	27	0
on-site (EU03)	SS-153	5/17/2018	0-2 ft BGS	9.1	1	370	1	0.11	1	12	1	20	0	24	0
on-site (EU04)	SS-138	5/17/2018	0-2 ft BGS	30	1	180	1	1.125	1	58.5	1	31	0	37.5	0
on-site (EU04)	SS-139	5/17/2018	0-2 ft BGS	20	1	320	1	0.13	1	15	1	21	0	25	0
on-site (EU04)	SS-140	5/17/2018	0.17-2.17 ft BGS	25	1	280	1	0.96	1	38	1	26	0	32	0
on-site (EU04)	SS-142	5/29/2018	0-2 ft BGS	57	1	370	1	0.18	1	19	1	21	0	110	1
on-site (EU04)	SS-144	5/29/2018	0.17-2.17 ft BGS	13	1	410	1	0.3	1	20	1	23	0	28	0
on-site (EU04)	SS-145	5/29/2018	0-2 ft BGS	130	1	410	1	0.21	1	17	1	22	0	27	1
on-site (EU03)	BH152-18	5/29/2018	9-11 ft BGS	550	1	470	1	0.16	1	19	1	23	0	70	1
on-site (EU03)	BH153-18	5/29/2018	13-15 ft BGS	68	1	430	1	0.15	1	21	1	980	1	1300	1
on-site (EU03)	BH154-18	5/29/2018	13-15 ft BGS	34	1	370	1	0.1	1	10	1	20	0	24	0
on-site (EU03)	BH155-18	5/29/2018	13-15 ft BGS	14	1	280	1	0.16	1	22.5	1	22.5	0	26.5	0
on-site (EU03)	BH156-18	5/16/2018	13-15 ft BGS	34	1	480	1	0.15	1	15	1	24	0	29	0
on-site (EU03)	BH157-18	5/17/2018	12-14 ft BGS	6.8	1	340	1	0.083	1	5.2	1	20	0	25	0
on-site (EU03)	GP07-18	8/1/2018	12-13 ft bgs												
on-site (EU03)	TT-18	10/1/2008	12 ft BGS					0.11	0			35	0	35	0
on-site (EU03)	TT-18	10/1/2008	12- ft BGS	9.1	1	297	1			6.2	1				
on-site (EU03)	TT-18	10/1/2008	5 ft BGS									45	0	45	0
on-site (EU03)	TT-18	10/1/2008	5- ft BGS	6.4	1	84.9	1	0.54	1	28.2	1				
on-site (EU04)	BH146-18	5/17/2018	13-15 ft BGS	2.1	1	37	1	0.078	0	14	1	37	0	44	0
on-site (EU04)	BH147-18	5/17/2018	12-14 ft BGS	4.2	1	280	1	0.083	1	9	1	21	0	26	0
on-site (EU04)	BH148-18	5/17/2018	6-8 ft BGS	19	1	76	1	1.5	1	70	1	30	0	36	0
on-site (EU04)	BH149-18	5/29/2018	10-12 ft BGS	12	1	160	1	0.38	1	22	1	22	0	37	1
on-site (EU04)	BH150-18	5/29/2018	13-15 ft BGS	30	1	350	1	0.28	1	26	1	23	0	210	1
on-site (EU04)	BH151-18	5/29/2018	10-12 ft BGS	40	1	620	1	0.16	1	20	1	22	0	31	1
on-site (EU04)	GP08-19	1/15/2019	11.67-12.67 ft BGS												
on-site (EU04)	TT-17	9/30/2008	14 ft BGS									41	0	41	0
on-site (EU04)	TT-17	9/30/2008	14- ft BGS	7.5	1	76	1	0.46	1	13.8	1				
on-site (EU04)	TT-17	9/30/2008	5 ft BGS					0.15	0			36	0	36	0
on-site (EU04)	TT-17	9/30/2008	5- ft BGS	14.9	1	441	1			18.1	1				

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	27
		Number of Missing Observations	6
Number of Detects	26	Number of Non-Detects	2
Number of Distinct Detects	25	Number of Distinct Non-Detects	2
Minimum Detect	13	Minimum Non-Detect	0.97
Maximum Detect	260000	Maximum Non-Detect	9.1
Variance Detects	2.591E+9	Percent Non-Detects	7.143%
Mean Detects	10490	SD Detects	50904
Median Detects	81	CV Detects	4.852
Skewness Detects	5.095	Kurtosis Detects	25.97
Mean of Logged Detects	5.054	SD of Logged Detects	2.241

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.213	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.497	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9741	KM Standard Error of Mean	9285
KM SD	48175	95% KM (BCA) UCL	28415
95% KM (t) UCL	25555	95% KM (Percentile Bootstrap) UCL	28253
95% KM (z) UCL	25013	95% KM Bootstrap t UCL	1222715
90% KM Chebyshev UCL	37595	95% KM Chebyshev UCL	50212
97.5% KM Chebyshev UCL	67723	99% KM Chebyshev UCL	102121

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.122	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.922	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.369	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.192	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.178	k star (bias corrected MLE)	0.183
Theta hat (MLE)	58871	Theta star (bias corrected MLE)	57239
nu hat (MLE)	9.266	nu star (bias corrected)	9.53
Mean (detects)	10490		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	9741
Maximum	260000	Median	71.5
SD	49059	CV	5.036
k hat (MLE)	0.158	k star (bias corrected MLE)	0.165
Theta hat (MLE)	61567	Theta star (bias corrected MLE)	59009
nu hat (MLE)	8.86	nu star (bias corrected)	9.244
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (9.24, α)	3.475	Adjusted Chi Square Value (9.24, β)	3.259
95% Gamma Approximate UCL (use when n>=50)	25912	95% Gamma Adjusted UCL (use when n<50)	27631

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9741	SD (KM)	48175
Variance (KM)	2.321E+9	SE of Mean (KM)	9285
k hat (KM)	0.0409	k star (KM)	0.0603
nu hat (KM)	2.29	nu star (KM)	3.378
theta hat (KM)	238253	theta star (KM)	161505
80% gamma percentile (KM)	2386	90% gamma percentile (KM)	18421
95% gamma percentile (KM)	54658	99% gamma percentile (KM)	196079

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.38, α)	0.493	Adjusted Chi Square Value (3.38, β)	0.434
95% Gamma Approximate KM-UCL (use when n>=50)	66798	95% Gamma Adjusted KM-UCL (use when n<50)	75811

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9741	Mean in Log Scale	4.696
SD in Original Scale	49059	SD in Log Scale	2.526
95% t UCL (assumes normality of ROS data)	25533	95% Percentile Bootstrap UCL	28192
95% BCA Bootstrap UCL	38129	95% Bootstrap t UCL	1228126
95% H-UCL (Log ROS)	26464		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.691	KM Geo Mean	109
KM SD (logged)	2.489	95% Critical H Value (KM-Log)	4.666
KM Standard Error of Mean (logged)	0.48	95% H-UCL (KM -Log)	22574
KM SD (logged)	2.489	95% Critical H Value (KM-Log)	4.666
KM Standard Error of Mean (logged)	0.48		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9741	Mean in Log Scale	4.721
SD in Original Scale	49059	SD in Log Scale	2.497
95% t UCL (Assumes normality)	25533	95% H-Stat UCL	23998

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	67723

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	27
		Number of Missing Observations	6
Number of Detects	26	Number of Non-Detects	2
Number of Distinct Detects	25	Number of Distinct Non-Detects	2
Minimum Detect	10	Minimum Non-Detect	0.99
Maximum Detect	270000	Maximum Non-Detect	9.1
Variance Detects	2.795E+9	Percent Non-Detects	7.143%
Mean Detects	10834	SD Detects	52869
Median Detects	81	CV Detects	4.88
Skewness Detects	5.096	Kurtosis Detects	25.98
Mean of Logged Detects	5.001	SD of Logged Detects	2.281

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.211	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.507	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	10060	KM Standard Error of Mean	9643
KM SD	50034	95% KM (BCA) UCL	29357
95% KM (t) UCL	26484	95% KM (Percentile Bootstrap) UCL	29264
95% KM (z) UCL	25921	95% KM Bootstrap t UCL	1312903
90% KM Chebyshev UCL	38988	95% KM Chebyshev UCL	52092
97.5% KM Chebyshev UCL	70279	99% KM Chebyshev UCL	106005

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.083	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.924	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.362	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.192	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.175	k star (bias corrected MLE)	0.181
Theta hat (MLE)	61870	Theta star (bias corrected MLE)	60007
nu hat (MLE)	9.105	nu star (bias corrected)	9.388
Mean (detects)	10834		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	10060
Maximum	270000	Median	66
SD	50952	CV	5.065
k hat (MLE)	0.156	k star (bias corrected MLE)	0.163
Theta hat (MLE)	64520	Theta star (bias corrected MLE)	61709
nu hat (MLE)	8.731	nu star (bias corrected)	9.129
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (9.13, α)	3.405	Adjusted Chi Square Value (9.13, β)	3.192
95% Gamma Approximate UCL (use when n>=50)	26970	95% Gamma Adjusted UCL (use when n<50)	28775

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	10060	SD (KM)	50034
Variance (KM)	2.503E+9	SE of Mean (KM)	9643
k hat (KM)	0.0404	k star (KM)	0.0599
nu hat (KM)	2.264	nu star (KM)	3.355
theta hat (KM)	248848	theta star (KM)	167934
80% gamma percentile (KM)	2418	90% gamma percentile (KM)	18895
95% gamma percentile (KM)	56363	99% gamma percentile (KM)	203092

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.35, α)	0.485	Adjusted Chi Square Value (3.35, β)	0.427
95% Gamma Approximate KM-UCL (use when n>=50)	69611	95% Gamma Adjusted KM-UCL (use when n<50)	79039

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	10060	Mean in Log Scale	4.635
SD in Original Scale	50952	SD in Log Scale	2.574
95% t UCL (assumes normality of ROS data)	26461	95% Percentile Bootstrap UCL	29284
95% BCA Bootstrap UCL	48337	95% Bootstrap t UCL	1357854
95% H-UCL (Log ROS)	30594		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.643	KM Geo Mean	103.9
KM SD (logged)	2.512	95% Critical H Value (KM-Log)	4.703
KM Standard Error of Mean (logged)	0.484	95% H-UCL (KM -Log)	23688
KM SD (logged)	2.512	95% Critical H Value (KM-Log)	4.703
KM Standard Error of Mean (logged)	0.484		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	10060	Mean in Log Scale	4.673
SD in Original Scale	50952	SD in Log Scale	2.522
95% t UCL (Assumes normality)	26461	95% H-Stat UCL	25445

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	70279

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	27
		Number of Missing Observations	6
Number of Detects	26	Number of Non-Detects	2
Number of Distinct Detects	25	Number of Distinct Non-Detects	2
Minimum Detect	12	Minimum Non-Detect	0.91
Maximum Detect	330000	Maximum Non-Detect	9.1
Variance Detects	4.174E+9	Percent Non-Detects	7.143%
Mean Detects	13329	SD Detects	64605
Median Detects	110	CV Detects	4.847
Skewness Detects	5.095	Kurtosis Detects	25.97
Mean of Logged Detects	5.349	SD of Logged Detects	2.242

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.213	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.498	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	12377	KM Standard Error of Mean	11784
KM SD	61143	95% KM (BCA) UCL	35833
95% KM (t) UCL	32448	95% KM (Percentile Bootstrap) UCL	35861
95% KM (z) UCL	31760	95% KM Bootstrap t UCL	1537787
90% KM Chebyshev UCL	47728	95% KM Chebyshev UCL	63741
97.5% KM Chebyshev UCL	85966	99% KM Chebyshev UCL	129623

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.04	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.92	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.363	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.192	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.18	k star (bias corrected MLE)	0.185
Theta hat (MLE)	73950	Theta star (bias corrected MLE)	72015
nu hat (MLE)	9.373	nu star (bias corrected)	9.625
Mean (detects)	13329		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	12377
Maximum	330000	Median	97
SD	62265	CV	5.031
k hat (MLE)	0.159	k star (bias corrected MLE)	0.166
Theta hat (MLE)	77745	Theta star (bias corrected MLE)	74582
nu hat (MLE)	8.915	nu star (bias corrected)	9.293
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (9.29, α)	3.505	Adjusted Chi Square Value (9.29, β)	3.288
95% Gamma Approximate UCL (use when n>=50)	32816	95% Gamma Adjusted UCL (use when n<50)	34985

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	12377	SD (KM)	61143
Variance (KM)	3.738E+9	SE of Mean (KM)	11784
k hat (KM)	0.041	k star (KM)	0.0604
nu hat (KM)	2.295	nu star (KM)	3.382
theta hat (KM)	302042	theta star (KM)	204929
80% gamma percentile (KM)	3044	90% gamma percentile (KM)	23438
95% gamma percentile (KM)	69469	99% gamma percentile (KM)	248992

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.38, α)	0.494	Adjusted Chi Square Value (3.38, β)	0.435
95% Gamma Approximate KM-UCL (use when n>=50)	84720	95% Gamma Adjusted KM-UCL (use when n<50)	96144

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.163	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	12377	Mean in Log Scale	4.989
SD in Original Scale	62265	SD in Log Scale	2.531
95% t UCL (assumes normality of ROS data)	32420	95% Percentile Bootstrap UCL	35856
95% BCA Bootstrap UCL	59535	95% Bootstrap t UCL	1527733
95% H-UCL (Log ROS)	36139		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.96	KM Geo Mean	142.6
KM SD (logged)	2.54	95% Critical H Value (KM-Log)	4.748
KM Standard Error of Mean (logged)	0.49	95% H-UCL (KM -Log)	36597
KM SD (logged)	2.54	95% Critical H Value (KM-Log)	4.748
KM Standard Error of Mean (logged)	0.49		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	12377	Mean in Log Scale	4.993
SD in Original Scale	62265	SD in Log Scale	2.542
95% t UCL (Assumes normality)	32420	95% H-Stat UCL	38086

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	85966

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	26
		Number of Missing Observations	6
Number of Detects	22	Number of Non-Detects	6
Number of Distinct Detects	21	Number of Distinct Non-Detects	5
Minimum Detect	7.1	Minimum Non-Detect	0.74
Maximum Detect	130000	Maximum Non-Detect	9.1
Variance Detects	7.650E+8	Percent Non-Detects	21.43%
Mean Detects	6193	SD Detects	27658
Median Detects	64.5	CV Detects	4.466
Skewness Detects	4.687	Kurtosis Detects	21.98
Mean of Logged Detects	4.813	SD of Logged Detects	2.209

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.232	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.508	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4866	KM Standard Error of Mean	4659
KM SD	24087	95% KM (BCA) UCL	14159
95% KM (t) UCL	12802	95% KM (Percentile Bootstrap) UCL	14113
95% KM (z) UCL	12530	95% KM Bootstrap t UCL	576380
90% KM Chebyshev UCL	18844	95% KM Chebyshev UCL	25175
97.5% KM Chebyshev UCL	33962	99% KM Chebyshev UCL	51224

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	4.222	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.907	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.375	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.207	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.189	k star (bias corrected MLE)	0.194
Theta hat (MLE)	32694	Theta star (bias corrected MLE)	31940
nu hat (MLE)	8.335	nu star (bias corrected)	8.531
Mean (detects)	6193		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4866
Maximum	130000	Median	37
SD	24529	CV	5.041
k hat (MLE)	0.137	k star (bias corrected MLE)	0.146
Theta hat (MLE)	35581	Theta star (bias corrected MLE)	33348
nu hat (MLE)	7.658	nu star (bias corrected)	8.171
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (8.17, α)	2.835	Adjusted Chi Square Value (8.17, β)	2.643
95% Gamma Approximate UCL (use when n>=50)	14027	95% Gamma Adjusted UCL (use when n<50)	15042

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4866	SD (KM)	24087
Variance (KM)	5.802E+8	SE of Mean (KM)	4659
k hat (KM)	0.0408	k star (KM)	0.0603
nu hat (KM)	2.286	nu star (KM)	3.374
theta hat (KM)	119227	theta star (KM)	80765
80% gamma percentile (KM)	1189	90% gamma percentile (KM)	9193
95% gamma percentile (KM)	27298	99% gamma percentile (KM)	97995

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.37, α)	0.491	Adjusted Chi Square Value (3.37, β)	0.433
95% Gamma Approximate KM-UCL (use when n>=50)	33416	95% Gamma Adjusted KM-UCL (use when n<50)	37927

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.873	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.199	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4866	Mean in Log Scale	3.781
SD in Original Scale	24529	SD in Log Scale	2.806
95% t UCL (assumes normality of ROS data)	12762	95% Percentile Bootstrap UCL	14121
95% BCA Bootstrap UCL	18906	95% Bootstrap t UCL	545843
95% H-UCL (Log ROS)	36994		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.731	KM Geo Mean	41.71
KM SD (logged)	2.826	95% Critical H Value (KM-Log)	5.216
KM Standard Error of Mean (logged)	0.548	95% H-UCL (KM -Log)	38594
KM SD (logged)	2.826	95% Critical H Value (KM-Log)	5.216
KM Standard Error of Mean (logged)	0.548		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4866	Mean in Log Scale	3.693
SD in Original Scale	24529	SD in Log Scale	2.957
95% t UCL (Assumes normality)	12762	95% H-Stat UCL	69888

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	33962

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	28	Number of Distinct Observations	20
		Number of Missing Observations	5
Number of Detects	8	Number of Non-Detects	20
Number of Distinct Detects	8	Number of Distinct Non-Detects	14
Minimum Detect	22	Minimum Non-Detect	20
Maximum Detect	92000	Maximum Non-Detect	200
Variance Detects	1.050E+9	Percent Non-Detects	71.43%
Mean Detects	11826	SD Detects	32401
Median Detects	145	CV Detects	2.74
Skewness Detects	2.827	Kurtosis Detects	7.992
Mean of Logged Detects	5.676	SD of Logged Detects	2.736

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.431	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.497	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3394	KM Standard Error of Mean	3446
KM SD	17056	95% KM (BCA) UCL	9953
95% KM (t) UCL	9263	95% KM (Percentile Bootstrap) UCL	9956
95% KM (z) UCL	9062	95% KM Bootstrap t UCL	735598
90% KM Chebyshev UCL	13731	95% KM Chebyshev UCL	18414
97.5% KM Chebyshev UCL	24913	99% KM Chebyshev UCL	37679

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.282	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.837	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.348	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.323	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.199	k star (bias corrected MLE)	0.208
Theta hat (MLE)	59447	Theta star (bias corrected MLE)	56947
nu hat (MLE)	3.183	nu star (bias corrected)	3.323
Mean (detects)	11826		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3379
Maximum	92000	Median	0.01
SD	17372	CV	5.141
k hat (MLE)	0.0846	k star (bias corrected MLE)	0.0994
Theta hat (MLE)	39927	Theta star (bias corrected MLE)	34003
nu hat (MLE)	4.739	nu star (bias corrected)	5.565
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (5.56, α)	1.422	Adjusted Chi Square Value (5.56, β)	1.297
95% Gamma Approximate UCL (use when n>=50)	13226	95% Gamma Adjusted UCL (use when n<50)	14492

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.d')

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3394	SD (KM)	17056
Variance (KM)	2.909E+8	SE of Mean (KM)	3446
k hat (KM)	0.0396	k star (KM)	0.0592
nu hat (KM)	2.218	nu star (KM)	3.313
theta hat (KM)	85708	theta star (KM)	57364
80% gamma percentile (KM)	787.4	90% gamma percentile (KM)	6295
95% gamma percentile (KM)	18962	99% gamma percentile (KM)	68883

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.31, α)	0.471	Adjusted Chi Square Value (3.31, β)	0.414
95% Gamma Approximate KM-UCL (use when n>=50)	23876	95% Gamma Adjusted KM-UCL (use when n<50)	27131

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3379	Mean in Log Scale	0.0609
SD in Original Scale	17371	SD in Log Scale	4.107
95% t UCL (assumes normality of ROS data)	8971	95% Percentile Bootstrap UCL	9938
95% BCA Bootstrap UCL	16434	95% Bootstrap t UCL	769606
95% H-UCL (Log ROS)	1648157		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.783	KM Geo Mean	43.93
KM SD (logged)	1.824	95% Critical H Value (KM-Log)	3.613
KM Standard Error of Mean (logged)	0.37	95% H-UCL (KM -Log)	823.6
KM SD (logged)	1.824	95% Critical H Value (KM-Log)	3.613
KM Standard Error of Mean (logged)	0.37		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3395	Mean in Log Scale	3.652
SD in Original Scale	17368	SD in Log Scale	1.983
95% t UCL (Assumes normality)	8985	95% H-Stat UCL	1200

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	37679

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	25
		Number of Missing Observations	6
Number of Detects	26	Number of Non-Detects	2
Number of Distinct Detects	23	Number of Distinct Non-Detects	2
Minimum Detect	13	Minimum Non-Detect	1.7
Maximum Detect	250000	Maximum Non-Detect	9.1
Variance Detects	2.395E+9	Percent Non-Detects	7.143%
Mean Detects	10136	SD Detects	48937
Median Detects	103.5	CV Detects	4.828
Skewness Detects	5.094	Kurtosis Detects	25.97
Mean of Logged Detects	5.189	SD of Logged Detects	2.197

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.214	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.495	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9412	KM Standard Error of Mean	8926
KM SD	46315	95% KM (BCA) UCL	27197
95% KM (t) UCL	24616	95% KM (Percentile Bootstrap) UCL	27125
95% KM (z) UCL	24094	95% KM Bootstrap t UCL	1098327
90% KM Chebyshev UCL	36190	95% KM Chebyshev UCL	48320
97.5% KM Chebyshev UCL	65155	99% KM Chebyshev UCL	98225

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.023	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.916	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.375	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.191	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.185	k star (bias corrected MLE)	0.189
Theta hat (MLE)	54886	Theta star (bias corrected MLE)	53628
nu hat (MLE)	9.603	nu star (bias corrected)	9.828
Mean (detects)	10136		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	9412
Maximum	250000	Median	88.5
SD	47165	CV	5.011
k hat (MLE)	0.163	k star (bias corrected MLE)	0.169
Theta hat (MLE)	57764	Theta star (bias corrected MLE)	55597
nu hat (MLE)	9.125	nu star (bias corrected)	9.48
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (9.48, α)	3.62	Adjusted Chi Square Value (9.48, β)	3.398
95% Gamma Approximate UCL (use when n>=50)	24651	95% Gamma Adjusted UCL (use when n<50)	26258

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene (cont.d')

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9412	SD (KM)	46315
Variance (KM)	2.145E+9	SE of Mean (KM)	8926
k hat (KM)	0.0413	k star (KM)	0.0607
nu hat (KM)	2.313	nu star (KM)	3.398
theta hat (KM)	227907	theta star (KM)	155104
80% gamma percentile (KM)	2345	90% gamma percentile (KM)	17906
95% gamma percentile (KM)	52880	99% gamma percentile (KM)	188959

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.40, α)	0.5	Adjusted Chi Square Value (3.40, β)	0.44
95% Gamma Approximate KM-UCL (use when n>=50)	64025	95% Gamma Adjusted KM-UCL (use when n<50)	72636

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.16	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9412	Mean in Log Scale	4.837
SD in Original Scale	47165	SD in Log Scale	2.479
95% t UCL (assumes normality of ROS data)	24594	95% Percentile Bootstrap UCL	27212
95% BCA Bootstrap UCL	36265	95% Bootstrap t UCL	1070504
95% H-UCL (Log ROS)	25044		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.857	KM Geo Mean	128.6
KM SD (logged)	2.398	95% Critical H Value (KM-Log)	4.517
KM Standard Error of Mean (logged)	0.462	95% H-UCL (KM -Log)	18305
KM SD (logged)	2.398	95% Critical H Value (KM-Log)	4.517
KM Standard Error of Mean (logged)	0.462		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9412	Mean in Log Scale	4.867
SD in Original Scale	47165	SD in Log Scale	2.433
95% t UCL (Assumes normality)	24594	95% H-Stat UCL	21379

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	65155

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	26
		Number of Missing Observations	6
Number of Detects	16	Number of Non-Detects	12
Number of Distinct Detects	15	Number of Distinct Non-Detects	11
Minimum Detect	6.2	Minimum Non-Detect	0.72
Maximum Detect	39000	Maximum Non-Detect	9.1
Variance Detects	94576287	Percent Non-Detects	42.86%
Mean Detects	2536	SD Detects	9725
Median Detects	25.5	CV Detects	3.834
Skewness Detects	3.998	Kurtosis Detects	15.99
Mean of Logged Detects	4.094	SD of Logged Detects	2.225

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.284	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.514	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1450	KM Standard Error of Mean	1411
KM SD	7228	95% KM (BCA) UCL	4240
95% KM (t) UCL	3853	95% KM (Percentile Bootstrap) UCL	4222
95% KM (z) UCL	3770	95% KM Bootstrap t UCL	184940
90% KM Chebyshev UCL	5682	95% KM Chebyshev UCL	7599
97.5% KM Chebyshev UCL	10260	99% KM Chebyshev UCL	15486

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.147	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.886	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.384	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.239	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.197	k star (bias corrected MLE)	0.202
Theta hat (MLE)	12875	Theta star (bias corrected MLE)	12573
nu hat (MLE)	6.304	nu star (bias corrected)	6.456
Mean (detects)	2536		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1449
Maximum	39000	Median	10.15
SD	7360	CV	5.078
k hat (MLE)	0.115	k star (bias corrected MLE)	0.127
Theta hat (MLE)	12568	Theta star (bias corrected MLE)	11432
nu hat (MLE)	6.458	nu star (bias corrected)	7.1
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (7.10, α)	2.225	Adjusted Chi Square Value (7.10, β)	2.061
95% Gamma Approximate UCL (use when n>=50)	4624	95% Gamma Adjusted UCL (use when n<50)	4994

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1450	SD (KM)	7228
Variance (KM)	52240464	SE of Mean (KM)	1411
k hat (KM)	0.0402	k star (KM)	0.0597
nu hat (KM)	2.253	nu star (KM)	3.345
theta hat (KM)	36034	theta star (KM)	24271
80% gamma percentile (KM)	345.6	90% gamma percentile (KM)	2715
95% gamma percentile (KM)	8117	99% gamma percentile (KM)	29304

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.34, α)	0.482	Adjusted Chi Square Value (3.34, β)	0.424
95% Gamma Approximate KM-UCL (use when n>=50)	10070	95% Gamma Adjusted KM-UCL (use when n<50)	11436

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.823	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1450	Mean in Log Scale	1.791
SD in Original Scale	7360	SD in Log Scale	3.187
95% t UCL (assumes normality of ROS data)	3819	95% Percentile Bootstrap UCL	4226
95% BCA Bootstrap UCL	6983	95% Bootstrap t UCL	183892
95% H-UCL (Log ROS)	34050		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.213	KM Geo Mean	9.142
KM SD (logged)	2.721	95% Critical H Value (KM-Log)	5.043
KM Standard Error of Mean (logged)	0.532	95% H-UCL (KM -Log)	5190
KM SD (logged)	2.721	95% Critical H Value (KM-Log)	5.043
KM Standard Error of Mean (logged)	0.532		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1450	Mean in Log Scale	2.169
SD in Original Scale	7360	SD in Log Scale	2.862
95% t UCL (Assumes normality)	3819	95% H-Stat UCL	9594

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	10260

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran

General Statistics

Total Number of Observations	28	Number of Distinct Observations	21
		Number of Missing Observations	5
Number of Detects	8	Number of Non-Detects	20
Number of Distinct Detects	8	Number of Distinct Non-Detects	14
Minimum Detect	16	Minimum Non-Detect	14
Maximum Detect	30000	Maximum Non-Detect	140
Variance Detects	1.105E+8	Percent Non-Detects	71.43%
Mean Detects	4027	SD Detects	10510
Median Detects	92	CV Detects	2.61
Skewness Detects	2.812	Kurtosis Detects	7.929
Mean of Logged Detects	5.404	SD of Logged Detects	2.374

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.451	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.463	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1161	KM Standard Error of Mean	1123
KM SD	5559	95% KM (BCA) UCL	3352
95% KM (t) UCL	3074	95% KM (Percentile Bootstrap) UCL	3297
95% KM (z) UCL	3008	95% KM Bootstrap t UCL	169190
90% KM Chebyshev UCL	4530	95% KM Chebyshev UCL	6056
97.5% KM Chebyshev UCL	8175	99% KM Chebyshev UCL	12335

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.306	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.818	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.387	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.32	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.246	k star (bias corrected MLE)	0.237
Theta hat (MLE)	16382	Theta star (bias corrected MLE)	16994
nu hat (MLE)	3.933	nu star (bias corrected)	3.792
Mean (detects)	4027		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1151
Maximum	30000	Median	0.01
SD	5663	CV	4.921
k hat (MLE)	0.0932	k star (bias corrected MLE)	0.107
Theta hat (MLE)	12351	Theta star (bias corrected MLE)	10755
nu hat (MLE)	5.217	nu star (bias corrected)	5.992
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (5.99, α)	1.636	Adjusted Chi Square Value (5.99, β)	1.5
95% Gamma Approximate UCL (use when n>=50)	4215	95% Gamma Adjusted UCL (use when n<50)	4597

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1161	SD (KM)	5559
Variance (KM)	30899876	SE of Mean (KM)	1123
k hat (KM)	0.0436	k star (KM)	0.0628
nu hat (KM)	2.444	nu star (KM)	3.515
theta hat (KM)	26609	theta star (KM)	18499
80% gamma percentile (KM)	317.3	90% gamma percentile (KM)	2282
95% gamma percentile (KM)	6569	99% gamma percentile (KM)	22973

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.52, α)	0.54	Adjusted Chi Square Value (3.52, β)	0.477
95% Gamma Approximate KM-UCL (use when n>=50)	7557	95% Gamma Adjusted KM-UCL (use when n<50)	8554

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1151	Mean in Log Scale	0.257
SD in Original Scale	5663	SD in Log Scale	3.731
95% t UCL (assumes normality of ROS data)	2974	95% Percentile Bootstrap UCL	3283
95% BCA Bootstrap UCL	4416	95% Bootstrap t UCL	163544
95% H-UCL (Log ROS)	170459		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.447	KM Geo Mean	31.42
KM SD (logged)	1.721	95% Critical H Value (KM-Log)	3.458
KM Standard Error of Mean (logged)	0.349	95% H-UCL (KM -Log)	434.6
KM SD (logged)	1.721	95% Critical H Value (KM-Log)	3.458
KM Standard Error of Mean (logged)	0.349		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1162	Mean in Log Scale	3.336
SD in Original Scale	5661	SD in Log Scale	1.889
95% t UCL (Assumes normality)	2984	95% H-Stat UCL	645

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	8175

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	26
		Number of Missing Observations	6
Number of Detects	26	Number of Non-Detects	2
Number of Distinct Detects	24	Number of Distinct Non-Detects	2
Minimum Detect	19	Minimum Non-Detect	0.85
Maximum Detect	590000	Maximum Non-Detect	9.1
Variance Detects	1.334E+10	Percent Non-Detects	7.143%
Mean Detects	23880	SD Detects	115505
Median Detects	210	CV Detects	4.837
Skewness Detects	5.094	Kurtosis Detects	25.96
Mean of Logged Detects	5.778	SD of Logged Detects	2.326

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.214	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.492	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	22174	KM Standard Error of Mean	21068
KM SD	109315	95% KM (BCA) UCL	64460
95% KM (t) UCL	58058	95% KM (Percentile Bootstrap) UCL	64070
95% KM (z) UCL	56827	95% KM Bootstrap t UCL	2704696
90% KM Chebyshev UCL	85377	95% KM Chebyshev UCL	114006
97.5% KM Chebyshev UCL	153742	99% KM Chebyshev UCL	231795

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	4.946	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.925	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.35	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.192	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.175	k star (bias corrected MLE)	0.18
Theta hat (MLE)	136725	Theta star (bias corrected MLE)	132559
nu hat (MLE)	9.082	nu star (bias corrected)	9.367
Mean (detects)	23880		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	22174
Maximum	590000	Median	150
SD	111321	CV	5.02
k hat (MLE)	0.154	k star (bias corrected MLE)	0.161
Theta hat (MLE)	143942	Theta star (bias corrected MLE)	137425
nu hat (MLE)	8.627	nu star (bias corrected)	9.036
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (9.04, α)	3.349	Adjusted Chi Square Value (9.04, β)	3.137
95% Gamma Approximate UCL (use when n>=50)	59834	95% Gamma Adjusted UCL (use when n<50)	63867

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	22174	SD (KM)	109315
Variance (KM)	1.195E+10	SE of Mean (KM)	21068
k hat (KM)	0.0411	k star (KM)	0.0605
nu hat (KM)	2.304	nu star (KM)	3.391
theta hat (KM)	538911	theta star (KM)	366228
80% gamma percentile (KM)	5491	90% gamma percentile (KM)	42092
95% gamma percentile (KM)	124521	99% gamma percentile (KM)	445599

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.39, α)	0.497	Adjusted Chi Square Value (3.39, β)	0.438
95% Gamma Approximate KM-UCL (use when n>=50)	151283	95% Gamma Adjusted KM-UCL (use when n<50)	171654

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	22174	Mean in Log Scale	5.403
SD in Original Scale	111321	SD in Log Scale	2.628
95% t UCL (assumes normality of ROS data)	58007	95% Percentile Bootstrap UCL	63986
95% BCA Bootstrap UCL	85718	95% Bootstrap t UCL	2546033
95% H-UCL (Log ROS)	83296		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.354	KM Geo Mean	211.5
KM SD (logged)	2.678	95% Critical H Value (KM-Log)	4.973
KM Standard Error of Mean (logged)	0.516	95% H-UCL (KM -Log)	99033
KM SD (logged)	2.678	95% Critical H Value (KM-Log)	4.973
KM Standard Error of Mean (logged)	0.516		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	22174	Mean in Log Scale	5.389
SD in Original Scale	111321	SD in Log Scale	2.675
95% t UCL (Assumes normality)	58007	95% H-Stat UCL	101221

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 153742

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	27
		Number of Missing Observations	6
Number of Detects	23	Number of Non-Detects	5
Number of Distinct Detects	23	Number of Distinct Non-Detects	4
Minimum Detect	7	Minimum Non-Detect	0.4
Maximum Detect	120000	Maximum Non-Detect	9.1
Variance Detects	6.235E+8	Percent Non-Detects	17.86%
Mean Detects	5480	SD Detects	24969
Median Detects	68	CV Detects	4.557
Skewness Detects	4.793	Kurtosis Detects	22.98
Mean of Logged Detects	4.772	SD of Logged Detects	2.143

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.227	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.507	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4501	KM Standard Error of Mean	4296
KM SD	22232	95% KM (BCA) UCL	13062
95% KM (t) UCL	11819	95% KM (Percentile Bootstrap) UCL	13043
95% KM (z) UCL	11567	95% KM Bootstrap t UCL	502544
90% KM Chebyshev UCL	17389	95% KM Chebyshev UCL	23227
97.5% KM Chebyshev UCL	31329	99% KM Chebyshev UCL	47245

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	4.494	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.904	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.373	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.201	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.193	k star (bias corrected MLE)	0.197
Theta hat (MLE)	28409	Theta star (bias corrected MLE)	27856
nu hat (MLE)	8.873	nu star (bias corrected)	9.049
Mean (detects)	5480		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4501
Maximum	120000	Median	39.5
SD	22640	CV	5.03
k hat (MLE)	0.145	k star (bias corrected MLE)	0.154
Theta hat (MLE)	30981	Theta star (bias corrected MLE)	29318
nu hat (MLE)	8.136	nu star (bias corrected)	8.598
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (8.60, α)	3.086	Adjusted Chi Square Value (8.60, β)	2.884
95% Gamma Approximate UCL (use when n>=50)	12541	95% Gamma Adjusted UCL (use when n<50)	13417

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4501	SD (KM)	22232
Variance (KM)	4.943E+8	SE of Mean (KM)	4296
k hat (KM)	0.041	k star (KM)	0.0604
nu hat (KM)	2.296	nu star (KM)	3.383
theta hat (KM)	109807	theta star (KM)	74512
80% gamma percentile (KM)	1108	90% gamma percentile (KM)	8526
95% gamma percentile (KM)	25266	99% gamma percentile (KM)	90545

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.38, α)	0.494	Adjusted Chi Square Value (3.38, β)	0.436
95% Gamma Approximate KM-UCL (use when n>=50)	30802	95% Gamma Adjusted KM-UCL (use when n<50)	34955

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.18	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4501	Mean in Log Scale	3.946
SD in Original Scale	22640	SD in Log Scale	2.65
95% t UCL (assumes normality of ROS data)	11789	95% Percentile Bootstrap UCL	13027
95% BCA Bootstrap UCL	21549	95% Bootstrap t UCL	503513
95% H-UCL (Log ROS)	21333		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.777	KM Geo Mean	43.67
KM SD (logged)	2.867	95% Critical H Value (KM-Log)	5.284
KM Standard Error of Mean (logged)	0.556	95% H-UCL (KM -Log)	49174
KM SD (logged)	2.867	95% Critical H Value (KM-Log)	5.284
KM Standard Error of Mean (logged)	0.556		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4501	Mean in Log Scale	3.773
SD in Original Scale	22640	SD in Log Scale	2.961
95% t UCL (Assumes normality)	11789	95% H-Stat UCL	77242

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	31329

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	24
		Number of Missing Observations	5
Number of Detects	20	Number of Non-Detects	8
Number of Distinct Detects	16	Number of Distinct Non-Detects	8
Minimum Detect	5.3	Minimum Non-Detect	0.87
Maximum Detect	18000	Maximum Non-Detect	9.1
Variance Detects	16083102	Percent Non-Detects	28.57%
Mean Detects	980.8	SD Detects	4010
Median Detects	22.5	CV Detects	4.089
Skewness Detects	4.456	Kurtosis Detects	19.9
Mean of Logged Detects	3.762	SD of Logged Detects	1.869

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.258	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.482	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	701	KM Standard Error of Mean	646.3
KM SD	3333	95% KM (BCA) UCL	1992
95% KM (t) UCL	1802	95% KM (Percentile Bootstrap) UCL	1962
95% KM (z) UCL	1764	95% KM Bootstrap t UCL	61541
90% KM Chebyshev UCL	2640	95% KM Chebyshev UCL	3518
97.5% KM Chebyshev UCL	4737	99% KM Chebyshev UCL	7131

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	4.139	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.878	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.395	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.214	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.23	k star (bias corrected MLE)	0.229
Theta hat (MLE)	4261	Theta star (bias corrected MLE)	4283
nu hat (MLE)	9.208	nu star (bias corrected)	9.16
Mean (detects)	980.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	700.6
Maximum	18000	Median	16.75
SD	3394	CV	4.845
k hat (MLE)	0.149	k star (bias corrected MLE)	0.156
Theta hat (MLE)	4716	Theta star (bias corrected MLE)	4478
nu hat (MLE)	8.319	nu star (bias corrected)	8.761
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (8.76, α)	3.183	Adjusted Chi Square Value (8.76, β)	2.978
95% Gamma Approximate UCL (use when n>=50)	1928	95% Gamma Adjusted UCL (use when n<50)	2061

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	701	SD (KM)	3333
Variance (KM)	11109332	SE of Mean (KM)	646.3
k hat (KM)	0.0442	k star (KM)	0.0633
nu hat (KM)	2.477	nu star (KM)	3.545
theta hat (KM)	15848	theta star (KM)	11074
80% gamma percentile (KM)	195.8	90% gamma percentile (KM)	1388
95% gamma percentile (KM)	3971	99% gamma percentile (KM)	13817

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.54, α)	0.551	Adjusted Chi Square Value (3.54, β)	0.487
95% Gamma Approximate KM-UCL (use when n>=50)	4513	95% Gamma Adjusted KM-UCL (use when n<50)	5105

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.808	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.192	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	700.8	Mean in Log Scale	2.628
SD in Original Scale	3394	SD in Log Scale	2.409
95% t UCL (assumes normality of ROS data)	1793	95% Percentile Bootstrap UCL	1962
95% BCA Bootstrap UCL	3230	95% Bootstrap t UCL	60584
95% H-UCL (Log ROS)	2065		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.696	KM Geo Mean	14.83
KM SD (logged)	2.301	95% Critical H Value (KM-Log)	4.362
KM Standard Error of Mean (logged)	0.45	95% H-UCL (KM -Log)	1446
KM SD (logged)	2.301	95% Critical H Value (KM-Log)	4.362
KM Standard Error of Mean (logged)	0.45		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	701.2	Mean in Log Scale	2.752
SD in Original Scale	3394	SD in Log Scale	2.32
95% t UCL (Assumes normality)	1794	95% H-Stat UCL	1642

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	3518

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	27
		Number of Missing Observations	6
Number of Detects	27	Number of Non-Detects	1
Number of Distinct Detects	26	Number of Distinct Non-Detects	1
Minimum Detect	5.8	Minimum Non-Detect	9.1
Maximum Detect	480000	Maximum Non-Detect	9.1
Variance Detects	8.508E+9	Percent Non-Detects	3.571%
Mean Detects	18687	SD Detects	92240
Median Detects	130	CV Detects	4.936
Skewness Detects	5.188	Kurtosis Detects	26.94
Mean of Logged Detects	5.248	SD of Logged Detects	2.36

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.21	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.492	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	18020	KM Standard Error of Mean	17131
KM SD	88952	95% KM (BCA) UCL	52740
95% KM (t) UCL	47198	95% KM (Percentile Bootstrap) UCL	52148
95% KM (z) UCL	46197	95% KM Bootstrap t UCL	2552130
90% KM Chebyshev UCL	69412	95% KM Chebyshev UCL	92690
97.5% KM Chebyshev UCL	125000	99% KM Chebyshev UCL	188467

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.469	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.935	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.374	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.189	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.165	k star (bias corrected MLE)	0.172
Theta hat (MLE)	113137	Theta star (bias corrected MLE)	108956
nu hat (MLE)	8.919	nu star (bias corrected)	9.262
Mean (detects)	18687		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	18020
Maximum	480000	Median	115
SD	90585	CV	5.027
k hat (MLE)	0.156	k star (bias corrected MLE)	0.163
Theta hat (MLE)	115604	Theta star (bias corrected MLE)	110561
nu hat (MLE)	8.729	nu star (bias corrected)	9.127
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (9.13, α)	3.404	Adjusted Chi Square Value (9.13, β)	3.19
95% Gamma Approximate UCL (use when n>=50)	48317	95% Gamma Adjusted UCL (use when n<50)	51551

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	18020	SD (KM)	88952
Variance (KM)	7.913E+9	SE of Mean (KM)	17131
k hat (KM)	0.041	k star (KM)	0.0605
nu hat (KM)	2.298	nu star (KM)	3.385
theta hat (KM)	439102	theta star (KM)	298092
80% gamma percentile (KM)	4442	90% gamma percentile (KM)	34153
95% gamma percentile (KM)	101158	99% gamma percentile (KM)	362367

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.39, α)	0.495	Adjusted Chi Square Value (3.39, β)	0.436
95% Gamma Approximate KM-UCL (use when n>=50)	123200	95% Gamma Adjusted KM-UCL (use when n<50)	139804

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.153	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.167	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	18020	Mean in Log Scale	5.081
SD in Original Scale	90585	SD in Log Scale	2.478
95% t UCL (assumes normality of ROS data)	47178	95% Percentile Bootstrap UCL	52173
95% BCA Bootstrap UCL	70291	95% Bootstrap t UCL	2288281
95% H-UCL (Log ROS)	31790		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.123	KM Geo Mean	167.9
KM SD (logged)	2.365	95% Critical H Value (KM-Log)	4.464
KM Standard Error of Mean (logged)	0.455	95% H-UCL (KM -Log)	20964
KM SD (logged)	2.365	95% Critical H Value (KM-Log)	4.464
KM Standard Error of Mean (logged)	0.455		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	18020	Mean in Log Scale	5.115
SD in Original Scale	90585	SD in Log Scale	2.421
95% t UCL (Assumes normality)	47178	95% H-Stat UCL	26044

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 125000

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene

General Statistics

Total Number of Observations	28	Number of Distinct Observations	28
		Number of Missing Observations	6
Number of Detects	26	Number of Non-Detects	2
Number of Distinct Detects	26	Number of Distinct Non-Detects	2
Minimum Detect	20	Minimum Non-Detect	0.68
Maximum Detect	450000	Maximum Non-Detect	9.1
Variance Detects	7.759E+9	Percent Non-Detects	7.143%
Mean Detects	18256	SD Detects	88087
Median Detects	170	CV Detects	4.825
Skewness Detects	5.094	Kurtosis Detects	25.96
Mean of Logged Detects	5.664	SD of Logged Detects	2.27

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.214	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.494	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	16952	KM Standard Error of Mean	16067
KM SD	83367	95% KM (BCA) UCL	48642
95% KM (t) UCL	44318	95% KM (Percentile Bootstrap) UCL	48809
95% KM (z) UCL	43379	95% KM Bootstrap t UCL	1834935
90% KM Chebyshev UCL	65152	95% KM Chebyshev UCL	86986
97.5% KM Chebyshev UCL	117289	99% KM Chebyshev UCL	176815

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	4.916	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.92	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.355	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.192	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.18	k star (bias corrected MLE)	0.185
Theta hat (MLE)	101276	Theta star (bias corrected MLE)	98627
nu hat (MLE)	9.373	nu star (bias corrected)	9.625
Mean (detects)	18256		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	16952
Maximum	450000	Median	130
SD	84896	CV	5.008
k hat (MLE)	0.159	k star (bias corrected MLE)	0.165
Theta hat (MLE)	106911	Theta star (bias corrected MLE)	102501
nu hat (MLE)	8.879	nu star (bias corrected)	9.261
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (9.26, α)	3.486	Adjusted Chi Square Value (9.26, β)	3.269
95% Gamma Approximate UCL (use when n>=50)	45042	95% Gamma Adjusted UCL (use when n<50)	48026

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene (cont.d')

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	16952	SD (KM)	83367
Variance (KM)	6.950E+9	SE of Mean (KM)	16067
k hat (KM)	0.0413	k star (KM)	0.0607
nu hat (KM)	2.315	nu star (KM)	3.401
theta hat (KM)	409983	theta star (KM)	279148
80% gamma percentile (KM)	4232	90% gamma percentile (KM)	32274
95% gamma percentile (KM)	95256	99% gamma percentile (KM)	340222

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.40, α)	0.5	Adjusted Chi Square Value (3.40, β)	0.441
95% Gamma Approximate KM-UCL (use when n>=50)	115202	95% Gamma Adjusted KM-UCL (use when n<50)	130690

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.878	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	16952	Mean in Log Scale	5.298
SD in Original Scale	84896	SD in Log Scale	2.564
95% t UCL (assumes normality of ROS data)	44279	95% Percentile Bootstrap UCL	48840
95% BCA Bootstrap UCL	65495	95% Bootstrap t UCL	1797908
95% H-UCL (Log ROS)	56823		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.232	KM Geo Mean	187.1
KM SD (logged)	2.651	95% Critical H Value (KM-Log)	4.929
KM Standard Error of Mean (logged)	0.511	95% H-UCL (KM -Log)	77737
KM SD (logged)	2.651	95% Critical H Value (KM-Log)	4.929
KM Standard Error of Mean (logged)	0.511		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	16952	Mean in Log Scale	5.275
SD in Original Scale	84896	SD in Log Scale	2.634
95% t UCL (Assumes normality)	44279	95% H-Stat UCL	75125

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL 117289

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	28	Number of Distinct Observations	28
		Number of Missing Observations	6
Minimum	1500	Mean	6330
Maximum	14000	Median	6100
SD	2893	Std. Error of Mean	546.8
Coefficient of Variation	0.457	Skewness	0.433

Normal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.086	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7262	95% Adjusted-CLT UCL (Chen-1995)	7278
		95% Modified-t UCL (Johnson-1978)	7269

Gamma GOF Test

A-D Test Statistic	0.41	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.119	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.166	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.34	k star (bias corrected MLE)	3.899
Theta hat (MLE)	1459	Theta star (bias corrected MLE)	1624
nu hat (MLE)	243.1	nu star (bias corrected)	218.3
MLE Mean (bias corrected)	6330	MLE Sd (bias corrected)	3206
		Approximate Chi Square Value (0.05)	185.1
Adjusted Level of Significance	0.0404	Adjusted Chi Square Value	183.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7465	95% Adjusted Gamma UCL (use when n<50)	7542

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.164	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.313	Mean of logged Data	8.634
Maximum of Logged Data	9.547	SD of logged Data	0.531

Assuming Lognormal Distribution

95% H-UCL	7910	90% Chebyshev (MVUE) UCL	8463
95% Chebyshev (MVUE) UCL	9383	97.5% Chebyshev (MVUE) UCL	10659
99% Chebyshev (MVUE) UCL	13168		

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7230	95% Jackknife UCL	7262
95% Standard Bootstrap UCL	7223	95% Bootstrap-t UCL	7390
95% Hall's Bootstrap UCL	7308	95% Percentile Bootstrap UCL	7195
95% BCA Bootstrap UCL	7255		
90% Chebyshev(Mean, Sd) UCL	7971	95% Chebyshev(Mean, Sd) UCL	8714
97.5% Chebyshev(Mean, Sd) UCL	9745	99% Chebyshev(Mean, Sd) UCL	11771

Suggested UCL to Use

95% Student's-t UCL	7262

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	28	Number of Distinct Observations	22
		Number of Missing Observations	5
Number of Detects	22	Number of Non-Detects	6
Number of Distinct Detects	18	Number of Distinct Non-Detects	5
Minimum Detect	0.13	Minimum Non-Detect	0.12
Maximum Detect	12	Maximum Non-Detect	6.6
Variance Detects	6.919	Percent Non-Detects	21.43%
Mean Detects	1.148	SD Detects	2.63
Median Detects	0.29	CV Detects	2.291
Skewness Detects	3.809	Kurtosis Detects	15.19
Mean of Logged Detects	-0.849	SD of Logged Detects	1.167

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.411	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.416	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.959	KM Standard Error of Mean	0.452
KM SD	2.322	95% KM (BCA) UCL	1.884
95% KM (t) UCL	1.73	95% KM (Percentile Bootstrap) UCL	1.755
95% KM (z) UCL	1.703	95% KM Bootstrap t UCL	5.787
90% KM Chebyshev UCL	2.316	95% KM Chebyshev UCL	2.93
97.5% KM Chebyshev UCL	3.783	99% KM Chebyshev UCL	5.458

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.621	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.794	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.259	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.194	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.622	k star (bias corrected MLE)	0.568
Theta hat (MLE)	1.844	Theta star (bias corrected MLE)	2.022
nu hat (MLE)	27.39	nu star (bias corrected)	24.98
Mean (detects)	1.148		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.904
Maximum	12	Median	0.225
SD	2.368	CV	2.619
k hat (MLE)	0.42	k star (bias corrected MLE)	0.399
Theta hat (MLE)	2.151	Theta star (bias corrected MLE)	2.266
nu hat (MLE)	23.53	nu star (bias corrected)	22.35
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (22.35, α)	12.6	Adjusted Chi Square Value (22.35, β)	12.15
95% Gamma Approximate UCL (use when n>=50)	1.604	95% Gamma Adjusted UCL (use when n<50)	1.663

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.959	SD (KM)	2.322
Variance (KM)	5.394	SE of Mean (KM)	0.452
k hat (KM)	0.171	k star (KM)	0.176
nu hat (KM)	9.557	nu star (KM)	9.866
theta hat (KM)	5.622	theta star (KM)	5.445
80% gamma percentile (KM)	1.174	90% gamma percentile (KM)	2.89
95% gamma percentile (KM)	5.101	99% gamma percentile (KM)	11.32

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.87, α)	3.858	Adjusted Chi Square Value (9.87, β)	3.628
95% Gamma Approximate KM-UCL (use when n>=50)	2.453	95% Gamma Adjusted KM-UCL (use when n<50)	2.609

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.19	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.929	Mean in Log Scale	-1.2
SD in Original Scale	2.359	SD in Log Scale	1.313
95% t UCL (assumes normality of ROS data)	1.689	95% Percentile Bootstrap UCL	1.748
95% BCA Bootstrap UCL	2.179	95% Bootstrap t UCL	5.993
95% H-UCL (Log ROS)	1.471		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.048	KM Geo Mean	0.351
KM SD (logged)	1.124	95% Critical H Value (KM-Log)	2.612
KM Standard Error of Mean (logged)	0.223	95% H-UCL (KM -Log)	1.162
KM SD (logged)	1.124	95% Critical H Value (KM-Log)	2.612
KM Standard Error of Mean (logged)	0.223		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.144	Mean in Log Scale	-0.964
SD in Original Scale	2.425	SD in Log Scale	1.358
95% t UCL (Assumes normality)	1.925	95% H-Stat UCL	2.063

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	2.93

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	28	Number of Distinct Observations	27
		Number of Missing Observations	6
Minimum	0.74	Mean	11.76
Maximum	56	Median	7.65
SD	12.99	Std. Error of Mean	2.455
Coefficient of Variation	1.105	Skewness	2.658

Normal GOF Test

Shapiro Wilk Test Statistic	0.602	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.348	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15.94	95% Adjusted-CLT UCL (Chen-1995)	17.12
		95% Modified-t UCL (Johnson-1978)	16.15

Gamma GOF Test

A-D Test Statistic	2.085	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.763	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.252	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.168	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.496	k star (bias corrected MLE)	1.36
Theta hat (MLE)	7.859	Theta star (bias corrected MLE)	8.648
nu hat (MLE)	83.8	nu star (bias corrected)	76.15
MLE Mean (bias corrected)	11.76	MLE Sd (bias corrected)	10.08
		Approximate Chi Square Value (0.05)	57.05
Adjusted Level of Significance	0.0404	Adjusted Chi Square Value	56.03

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	15.7	95% Adjusted Gamma UCL (use when n<50)	15.98

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.301	Mean of logged Data	2.095
Maximum of Logged Data	4.025	SD of logged Data	0.858

Assuming Lognormal Distribution

95% H-UCL	17.14	90% Chebyshev (MVUE) UCL	17.79
95% Chebyshev (MVUE) UCL	20.62	97.5% Chebyshev (MVUE) UCL	24.55
99% Chebyshev (MVUE) UCL	32.26		

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	15.8	95% Jackknife UCL	15.94
95% Standard Bootstrap UCL	15.77	95% Bootstrap-t UCL	20.06
95% Hall's Bootstrap UCL	20.11	95% Percentile Bootstrap UCL	16.08
95% BCA Bootstrap UCL	17.42		
90% Chebyshev(Mean, Sd) UCL	19.13	95% Chebyshev(Mean, Sd) UCL	22.46
97.5% Chebyshev(Mean, Sd) UCL	27.09	99% Chebyshev(Mean, Sd) UCL	36.19

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	22.46

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	28	Number of Distinct Observations	23
		Number of Missing Observations	6
Number of Detects	26	Number of Non-Detects	2
Number of Distinct Detects	21	Number of Distinct Non-Detects	2
Minimum Detect	0.091	Minimum Non-Detect	0.07
Maximum Detect	15	Maximum Non-Detect	0.68
Variance Detects	8.384	Percent Non-Detects	7.143%
Mean Detects	0.831	SD Detects	2.896
Median Detects	0.225	CV Detects	3.483
Skewness Detects	5.067	Kurtosis Detects	25.77
Mean of Logged Detects	-1.326	SD of Logged Detects	0.976

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.243	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.449	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.783	KM Standard Error of Mean	0.528
KM SD	2.742	95% KM (BCA) UCL	1.86
95% KM (t) UCL	1.683	95% KM (Percentile Bootstrap) UCL	1.826
95% KM (z) UCL	1.652	95% KM Bootstrap t UCL	13.89
90% KM Chebyshev UCL	2.368	95% KM Chebyshev UCL	3.086
97.5% KM Chebyshev UCL	4.083	99% KM Chebyshev UCL	6.041

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.673	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.804	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.4	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.181	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.549	k star (bias corrected MLE)	0.511
Theta hat (MLE)	1.516	Theta star (bias corrected MLE)	1.627
nu hat (MLE)	28.52	nu star (bias corrected)	26.56
Mean (detects)	0.831		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.773
Maximum	15	Median	0.218
SD	2.795	CV	3.617
k hat (MLE)	0.489	k star (bias corrected MLE)	0.461
Theta hat (MLE)	1.579	Theta star (bias corrected MLE)	1.678
nu hat (MLE)	27.4	nu star (bias corrected)	25.8
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (25.80, α)	15.22	Adjusted Chi Square Value (25.80, β)	14.72
95% Gamma Approximate UCL (use when n>=50)	1.309	95% Gamma Adjusted UCL (use when n<50)	1.354

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.783	SD (KM)	2.742
Variance (KM)	7.518	SE of Mean (KM)	0.528
k hat (KM)	0.0815	k star (KM)	0.0966
nu hat (KM)	4.564	nu star (KM)	5.408
theta hat (KM)	9.604	theta star (KM)	8.105
80% gamma percentile (KM)	0.516	90% gamma percentile (KM)	2.052
95% gamma percentile (KM)	4.551	99% gamma percentile (KM)	12.65

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.41, α)	1.345	Adjusted Chi Square Value (5.41, β)	1.226
95% Gamma Approximate KM-UCL (use when n>=50)	3.147	95% Gamma Adjusted KM-UCL (use when n<50)	3.454

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.691	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.278	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.781	Mean in Log Scale	-1.404
SD in Original Scale	2.792	SD in Log Scale	1.013
95% t UCL (assumes normality of ROS data)	1.68	95% Percentile Bootstrap UCL	1.836
95% BCA Bootstrap UCL	2.383	95% Bootstrap t UCL	14.33
95% H-UCL (Log ROS)	0.664		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.383	KM Geo Mean	0.251
KM SD (logged)	0.96	95% Critical H Value (KM-Log)	2.408
KM Standard Error of Mean (logged)	0.186	95% H-UCL (KM -Log)	0.621
KM SD (logged)	0.96	95% Critical H Value (KM-Log)	2.408
KM Standard Error of Mean (logged)	0.186		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.785	Mean in Log Scale	-1.39
SD in Original Scale	2.792	SD in Log Scale	1.016
95% t UCL (Assumes normality)	1.684	95% H-Stat UCL	0.678

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	3.086

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	28	Number of Distinct Observations	16
		Number of Missing Observations	6
Number of Detects	16	Number of Non-Detects	12
Number of Distinct Detects	11	Number of Distinct Non-Detects	7
Minimum Detect	0.31	Minimum Non-Detect	0.25
Maximum Detect	1.7	Maximum Non-Detect	1.5
Variance Detects	0.149	Percent Non-Detects	42.86%
Mean Detects	0.889	SD Detects	0.386
Median Detects	0.85	CV Detects	0.434
Skewness Detects	0.634	Kurtosis Detects	-0.219
Mean of Logged Detects	-0.21	SD of Logged Detects	0.452

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.65	KM Standard Error of Mean	0.0852
KM SD	0.42	95% KM (BCA) UCL	0.794
95% KM (t) UCL	0.795	95% KM (Percentile Bootstrap) UCL	0.792
95% KM (z) UCL	0.79	95% KM Bootstrap t UCL	0.814
90% KM Chebyshev UCL	0.906	95% KM Chebyshev UCL	1.021
97.5% KM Chebyshev UCL	1.182	99% KM Chebyshev UCL	1.497

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.258	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.139	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.615	k star (bias corrected MLE)	4.604
Theta hat (MLE)	0.158	Theta star (bias corrected MLE)	0.193
nu hat (MLE)	179.7	nu star (bias corrected)	147.3
Mean (detects)	0.889		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0494	Mean	0.623
Maximum	1.7	Median	0.53
SD	0.441	CV	0.709
k hat (MLE)	1.772	k star (bias corrected MLE)	1.606
Theta hat (MLE)	0.351	Theta star (bias corrected MLE)	0.388
nu hat (MLE)	99.25	nu star (bias corrected)	89.95
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (89.95, α)	69.08	Adjusted Chi Square Value (89.95, β)	67.95
95% Gamma Approximate UCL (use when n>=50)	0.811	95% Gamma Adjusted UCL (use when n<50)	0.824

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.65	SD (KM)	0.42
Variance (KM)	0.177	SE of Mean (KM)	0.0852
k hat (KM)	2.393	k star (KM)	2.161
nu hat (KM)	134	nu star (KM)	121
theta hat (KM)	0.272	theta star (KM)	0.301
80% gamma percentile (KM)	0.964	90% gamma percentile (KM)	1.242
95% gamma percentile (KM)	1.505	99% gamma percentile (KM)	2.086

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (121.00, α)	96.6	Adjusted Chi Square Value (121.00, β)	95.25
95% Gamma Approximate KM-UCL (use when n>=50)	0.814	95% Gamma Adjusted KM-UCL (use when n<50)	0.826

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.119	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.66	Mean in Log Scale	-0.583
SD in Original Scale	0.402	SD in Log Scale	0.588
95% t UCL (assumes normality of ROS data)	0.79	95% Percentile Bootstrap UCL	0.786
95% BCA Bootstrap UCL	0.804	95% Bootstrap t UCL	0.813
95% H-UCL (Log ROS)	0.833		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.643	KM Geo Mean	0.525
KM SD (logged)	0.659	95% Critical H Value (KM-Log)	2.082
KM Standard Error of Mean (logged)	0.135	95% H-UCL (KM -Log)	0.85
KM SD (logged)	0.659	95% Critical H Value (KM-Log)	2.082
KM Standard Error of Mean (logged)	0.135		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.628	Mean in Log Scale	-0.797
SD in Original Scale	0.452	SD in Log Scale	0.907
95% t UCL (Assumes normality)	0.774	95% H-Stat UCL	1.024

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.795

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	28	Number of Distinct Observations	23
		Number of Missing Observations	6
Minimum	0.77	Mean	6.145
Maximum	27	Median	5.25
SD	5.145	Std. Error of Mean	0.972
Coefficient of Variation	0.837	Skewness	2.854

Normal GOF Test

Shapiro Wilk Test Statistic	0.691	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7.801	95% Adjusted-CLT UCL (Chen-1995)	8.305
		95% Modified-t UCL (Johnson-1978)	7.889

Gamma GOF Test

A-D Test Statistic	0.991	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.166	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.167	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.252	k star (bias corrected MLE)	2.035
Theta hat (MLE)	2.729	Theta star (bias corrected MLE)	3.02
nu hat (MLE)	126.1	nu star (bias corrected)	113.9
MLE Mean (bias corrected)	6.145	MLE Sd (bias corrected)	4.308
		Approximate Chi Square Value (0.05)	90.3
Adjusted Level of Significance	0.0404	Adjusted Chi Square Value	89

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	7.754	95% Adjusted Gamma UCL (use when n<50)	7.868

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.164	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.261	Mean of logged Data	1.578
Maximum of Logged Data	3.296	SD of logged Data	0.703

Assuming Lognormal Distribution

95% H-UCL	8.264	90% Chebyshev (MVUE) UCL	8.773
95% Chebyshev (MVUE) UCL	9.968	97.5% Chebyshev (MVUE) UCL	11.63
99% Chebyshev (MVUE) UCL	14.89		

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7.745	95% Jackknife UCL	7.801
95% Standard Bootstrap UCL	7.69	95% Bootstrap-t UCL	9.125
95% Hall's Bootstrap UCL	14.42	95% Percentile Bootstrap UCL	7.788
95% BCA Bootstrap UCL	8.323		
90% Chebyshev(Mean, Sd) UCL	9.062	95% Chebyshev(Mean, Sd) UCL	10.38
97.5% Chebyshev(Mean, Sd) UCL	12.22	99% Chebyshev(Mean, Sd) UCL	15.82

Suggested UCL to Use

95% Adjusted Gamma UCL	7.868

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	28	Number of Distinct Observations	20
		Number of Missing Observations	6
Minimum	1200	Mean	13783
Maximum	54000	Median	13500
SD	8980	Std. Error of Mean	1697
Coefficient of Variation	0.651	Skewness	3.422

Normal GOF Test

Shapiro Wilk Test Statistic	0.656	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	16674	95% Adjusted-CLT UCL (Chen-1995)	17747
		95% Modified-t UCL (Johnson-1978)	16857

Gamma GOF Test

A-D Test Statistic	1.412	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.752	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.166	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.325	k star (bias corrected MLE)	2.993
Theta hat (MLE)	4145	Theta star (bias corrected MLE)	4606
nu hat (MLE)	186.2	nu star (bias corrected)	167.6
MLE Mean (bias corrected)	13783	MLE Sd (bias corrected)	7968
		Approximate Chi Square Value (0.05)	138.7
Adjusted Level of Significance	0.0404	Adjusted Chi Square Value	137

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	16660	95% Adjusted Gamma UCL (use when n<50)	16857

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.822	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.204	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.09	Mean of logged Data	9.373
Maximum of Logged Data	10.9	SD of logged Data	0.616

Assuming Lognormal Distribution

95% H-UCL	18123	90% Chebyshev (MVUE) UCL	19356
95% Chebyshev (MVUE) UCL	21729	97.5% Chebyshev (MVUE) UCL	25023
99% Chebyshev (MVUE) UCL	31494		

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	16574	95% Jackknife UCL	16674
95% Standard Bootstrap UCL	16525	95% Bootstrap-t UCL	18719
95% Hall's Bootstrap UCL	29760	95% Percentile Bootstrap UCL	16850
95% BCA Bootstrap UCL	17976		
90% Chebyshev(Mean, Sd) UCL	18874	95% Chebyshev(Mean, Sd) UCL	21180
97.5% Chebyshev(Mean, Sd) UCL	24381	99% Chebyshev(Mean, Sd) UCL	30668

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	21180

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	28	Number of Distinct Observations	24
		Number of Missing Observations	6
Minimum	2.1	Mean	80.29
Maximum	1000	Median	21.5
SD	207.2	Std. Error of Mean	39.15
Coefficient of Variation	2.58	Skewness	3.929

Normal GOF Test

Shapiro Wilk Test Statistic	0.384	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.417	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	147	95% Adjusted-CLT UCL (Chen-1995)	175.7
		95% Modified-t UCL (Johnson-1978)	151.8

Gamma GOF Test

A-D Test Statistic	3.097	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.808	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.273	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.175	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.519	k star (bias corrected MLE)	0.487
Theta hat (MLE)	154.6	Theta star (bias corrected MLE)	164.7
nu hat (MLE)	29.08	nu star (bias corrected)	27.3
MLE Mean (bias corrected)	80.29	MLE Sd (bias corrected)	115
		Approximate Chi Square Value (0.05)	16.38
Adjusted Level of Significance	0.0404	Adjusted Chi Square Value	15.86

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	133.8	95% Adjusted Gamma UCL (use when n<50)	138.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.164	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.742	Mean of logged Data	3.17
Maximum of Logged Data	6.908	SD of logged Data	1.317

Assuming Lognormal Distribution

95% H-UCL	117.2	90% Chebyshev (MVUE) UCL	102.4
95% Chebyshev (MVUE) UCL	124.4	97.5% Chebyshev (MVUE) UCL	155
99% Chebyshev (MVUE) UCL	215.2		

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	144.7	95% Jackknife UCL	147
95% Standard Bootstrap UCL	144.6	95% Bootstrap-t UCL	646.5
95% Hall's Bootstrap UCL	455.5	95% Percentile Bootstrap UCL	151.6
95% BCA Bootstrap UCL	187.4		
90% Chebyshev(Mean, Sd) UCL	197.7	95% Chebyshev(Mean, Sd) UCL	250.9
97.5% Chebyshev(Mean, Sd) UCL	324.8	99% Chebyshev(Mean, Sd) UCL	469.8

Suggested UCL to Use

95% H-UCL 117.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	28	Number of Distinct Observations	21
		Number of Missing Observations	6
Minimum	37	Mean	542.2
Maximum	6000	Median	370
SD	1082	Std. Error of Mean	204.4
Coefficient of Variation	1.995	Skewness	5.104

Normal GOF Test

Shapiro Wilk Test Statistic	0.32	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.41	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	890.4	95% Adjusted-CLT UCL (Chen-1995)	1089
		95% Modified-t UCL (Johnson-1978)	923.2

Gamma GOF Test

A-D Test Statistic	2.819	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.772	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.276	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.17	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.067	k star (bias corrected MLE)	0.977
Theta hat (MLE)	508	Theta star (bias corrected MLE)	555.1
nu hat (MLE)	59.77	nu star (bias corrected)	54.7
MLE Mean (bias corrected)	542.2	MLE Sd (bias corrected)	548.6
		Approximate Chi Square Value (0.05)	38.7
Adjusted Level of Significance	0.0404	Adjusted Chi Square Value	37.87

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	766.3	95% Adjusted Gamma UCL (use when n<50)	783.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.855	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.611	Mean of logged Data	5.759
Maximum of Logged Data	8.7	SD of logged Data	0.906

Assuming Lognormal Distribution

95% H-UCL	719.2	90% Chebyshev (MVUE) UCL	738.8
95% Chebyshev (MVUE) UCL	861.3	97.5% Chebyshev (MVUE) UCL	1031
99% Chebyshev (MVUE) UCL	1365		

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	878.4	95% Jackknife UCL	890.4
95% Standard Bootstrap UCL	882.5	95% Bootstrap-t UCL	2246
95% Hall's Bootstrap UCL	2468	95% Percentile Bootstrap UCL	938.6
95% BCA Bootstrap UCL	1161		
90% Chebyshev(Mean, Sd) UCL	1155	95% Chebyshev(Mean, Sd) UCL	1433
97.5% Chebyshev(Mean, Sd) UCL	1819	99% Chebyshev(Mean, Sd) UCL	2576

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	1433

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	28	Number of Distinct Observations	22
		Number of Missing Observations	5
Number of Detects	24	Number of Non-Detects	4
Number of Distinct Detects	20	Number of Distinct Non-Detects	4
Minimum Detect	0.083	Minimum Non-Detect	0.046
Maximum Detect	1.5	Maximum Non-Detect	0.15
Variance Detects	0.131	Percent Non-Detects	14.29%
Mean Detects	0.333	SD Detects	0.361
Median Detects	0.185	CV Detects	1.087
Skewness Detects	2.247	Kurtosis Detects	4.62
Mean of Logged Detects	-1.468	SD of Logged Detects	0.797

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.665	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.916	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.286	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.177	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.294	KM Standard Error of Mean	0.0658
KM SD	0.341	95% KM (BCA) UCL	0.402
95% KM (t) UCL	0.406	95% KM (Percentile Bootstrap) UCL	0.412
95% KM (z) UCL	0.402	95% KM Bootstrap t UCL	0.498
90% KM Chebyshev UCL	0.492	95% KM Chebyshev UCL	0.581
97.5% KM Chebyshev UCL	0.705	99% KM Chebyshev UCL	0.949

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.555	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.761	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.181	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.508	k star (bias corrected MLE)	1.347
Theta hat (MLE)	0.22	Theta star (bias corrected MLE)	0.247
nu hat (MLE)	72.39	nu star (bias corrected)	64.68
Mean (detects)	0.333		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.286
Maximum	1.5	Median	0.16
SD	0.353	CV	1.231
k hat (MLE)	0.88	k star (bias corrected MLE)	0.81
Theta hat (MLE)	0.325	Theta star (bias corrected MLE)	0.354
nu hat (MLE)	49.3	nu star (bias corrected)	45.35
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (45.35, α)	30.9	Adjusted Chi Square Value (45.35, β)	30.17
95% Gamma Approximate UCL (use when n>=50)	0.42	95% Gamma Adjusted UCL (use when n<50)	0.431

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.294	SD (KM)	0.341
Variance (KM)	0.116	SE of Mean (KM)	0.0658
k hat (KM)	0.744	k star (KM)	0.688
nu hat (KM)	41.64	nu star (KM)	38.51
theta hat (KM)	0.395	theta star (KM)	0.428
80% gamma percentile (KM)	0.484	90% gamma percentile (KM)	0.741
95% gamma percentile (KM)	1.007	99% gamma percentile (KM)	1.643

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (38.51, α)	25.3	Adjusted Chi Square Value (38.51, β)	24.63
95% Gamma Approximate KM-UCL (use when n>=50)	0.448	95% Gamma Adjusted KM-UCL (use when n<50)	0.46

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.916	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.177	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.292	Mean in Log Scale	-1.69
SD in Original Scale	0.348	SD in Log Scale	0.929
95% t UCL (assumes normality of ROS data)	0.404	95% Percentile Bootstrap UCL	0.404
95% BCA Bootstrap UCL	0.431	95% Bootstrap t UCL	0.479
95% H-UCL (Log ROS)	0.434		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.663	KM Geo Mean	0.19
KM SD (logged)	0.877	95% Critical H Value (KM-Log)	2.31
KM Standard Error of Mean (logged)	0.171	95% H-UCL (KM -Log)	0.411
KM SD (logged)	0.877	95% Critical H Value (KM-Log)	2.31
KM Standard Error of Mean (logged)	0.171		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.292	Mean in Log Scale	-1.705
SD in Original Scale	0.349	SD in Log Scale	0.959
95% t UCL (Assumes normality)	0.404	95% H-Stat UCL	0.449

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.411

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	28	Number of Distinct Observations	23
		Number of Missing Observations	6
Minimum	5.2	Mean	26.66
Maximum	170	Median	19
SD	31.35	Std. Error of Mean	5.925
Coefficient of Variation	1.176	Skewness	3.904

Normal GOF Test

Shapiro Wilk Test Statistic	0.518	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.339	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	36.75	95% Adjusted-CLT UCL (Chen-1995)	41.08
		95% Modified-t UCL (Johnson-1978)	37.48

Gamma GOF Test

A-D Test Statistic	2.04	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.76	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.273	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.168	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.806	k star (bias corrected MLE)	1.637
Theta hat (MLE)	14.76	Theta star (bias corrected MLE)	16.29
nu hat (MLE)	101.2	nu star (bias corrected)	91.65
MLE Mean (bias corrected)	26.66	MLE Sd (bias corrected)	20.84
		Approximate Chi Square Value (0.05)	70.57
Adjusted Level of Significance	0.0404	Adjusted Chi Square Value	69.43

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	34.62	95% Adjusted Gamma UCL (use when n<50)	35.19

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.924	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.21	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.164	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.649	Mean of logged Data	2.982
Maximum of Logged Data	5.136	SD of logged Data	0.695

Assuming Lognormal Distribution

95% H-UCL	33.31	90% Chebyshev (MVUE) UCL	35.39
95% Chebyshev (MVUE) UCL	40.17	97.5% Chebyshev (MVUE) UCL	46.8
99% Chebyshev (MVUE) UCL	59.82		

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	36.41	95% Jackknife UCL	36.75
95% Standard Bootstrap UCL	36.28	95% Bootstrap-t UCL	53.35
95% Hall's Bootstrap UCL	72.06	95% Percentile Bootstrap UCL	37.34
95% BCA Bootstrap UCL	42.3		
90% Chebyshev(Mean, Sd) UCL	44.43	95% Chebyshev(Mean, Sd) UCL	52.49
97.5% Chebyshev(Mean, Sd) UCL	63.66	99% Chebyshev(Mean, Sd) UCL	85.61

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	52.49

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	28	Number of Distinct Observations	15
		Number of Missing Observations	5
Number of Detects	1	Number of Non-Detects	27
Number of Distinct Detects	1	Number of Distinct Non-Detects	14

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1242 (PCB-1242) was not processed!

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	28	Number of Distinct Observations	20
		Number of Missing Observations	5
Number of Detects	7	Number of Non-Detects	21
Number of Distinct Detects	7	Number of Distinct Non-Detects	14
Minimum Detect	27	Minimum Non-Detect	24
Maximum Detect	1300	Maximum Non-Detect	45
Variance Detects	216497	Percent Non-Detects	75%
Mean Detects	255	SD Detects	465.3
Median Detects	70	CV Detects	1.825
Skewness Detects	2.544	Kurtosis Detects	6.564
Mean of Logged Detects	4.544	SD of Logged Detects	1.373

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.567	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.396	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	82.06	KM Standard Error of Mean	48.46
KM SD	237.4	95% KM (BCA) UCL	179.5
95% KM (t) UCL	164.6	95% KM (Percentile Bootstrap) UCL	170.8
95% KM (z) UCL	161.8	95% KM Bootstrap t UCL	735.2
90% KM Chebyshev UCL	227.4	95% KM Chebyshev UCL	293.3
97.5% KM Chebyshev UCL	384.7	99% KM Chebyshev UCL	564.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.781	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.744	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.267	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.325	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.617	k star (bias corrected MLE)	0.448
Theta hat (MLE)	413.3	Theta star (bias corrected MLE)	569.5
nu hat (MLE)	8.637	nu star (bias corrected)	6.269
Mean (detects)	255		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	63.76
Maximum	1300	Median	0.01
SD	246.5	CV	3.866
k hat (MLE)	0.122	k star (bias corrected MLE)	0.133
Theta hat (MLE)	521.7	Theta star (bias corrected MLE)	479.6
nu hat (MLE)	6.844	nu star (bias corrected)	7.444
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (7.44, α)	2.417	Adjusted Chi Square Value (7.44, β)	2.244
95% Gamma Approximate UCL (use when n>=50)	196.3	95% Gamma Adjusted UCL (use when n<50)	211.5

Table B.5.4

Summary of ProUCL Output for EU03-EU04 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 8:57:29 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	82.06	SD (KM)	237.4
Variance (KM)	56364	SE of Mean (KM)	48.46
k hat (KM)	0.119	k star (KM)	0.13
nu hat (KM)	6.69	nu star (KM)	7.306
theta hat (KM)	686.9	theta star (KM)	628.9
80% gamma percentile (KM)	78.68	90% gamma percentile (KM)	237.3
95% gamma percentile (KM)	462.8	99% gamma percentile (KM)	1137

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.31, α)	2.34	Adjusted Chi Square Value (7.31, β)	2.17
95% Gamma Approximate KM-UCL (use when n>=50)	256.2	95% Gamma Adjusted KM-UCL (use when n<50)	276.3

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	64.88	Mean in Log Scale	1.201
SD in Original Scale	246.2	SD in Log Scale	2.215
95% t UCL (assumes normality of ROS data)	144.1	95% Percentile Bootstrap UCL	154
95% BCA Bootstrap UCL	208.4	95% Bootstrap t UCL	632.7
95% H-UCL (Log ROS)	234.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.531	KM Geo Mean	34.14
KM SD (logged)	0.865	95% Critical H Value (KM-Log)	2.297
KM Standard Error of Mean (logged)	0.177	95% H-UCL (KM -Log)	72.81
KM SD (logged)	0.865	95% Critical H Value (KM-Log)	2.297
KM Standard Error of Mean (logged)	0.177		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	75.21	Mean in Log Scale	3.164
SD in Original Scale	243.5	SD in Log Scale	1.054
95% t UCL (Assumes normality)	153.6	95% H-Stat UCL	68.78

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	276.3

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.1

Summary of ProUCL Input Data for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Aluminum	D_Aluminum
on-site (EU05-08)	SS-98	5/31/2018	0.17-2.17 ft BGS	47	1	70	1	94	1	21	0	0.74	0	5500	1
on-site (EU05-08)	SS-99	11/2/2018	0.25-2.25 ft BGS	160	1	180	1	280	1	22	0	40	1	5200	1
on-site (EU05-08)	SS-100	11/2/2018	0.17-2.17 ft BGS	335	1	295	1	455	1	42.5	1	62.5	1	4750	1
on-site (EU05-08)	SS-101	11/2/2018	0.25-2.25 ft BGS	1900	1	1400	1	1900	1	320	1	200	1	5100	1
on-site (EU05-08)	SS-102	5/30/2018	0-2 ft BGS	675	1	1275	1	1750	1	94	1	117.5	1	4800	1
on-site (EU05-08)	SS-103	5/30/2018	0-2 ft BGS	190	1	210	1	270	1	37	1	22	1	9400	1
on-site (EU05-08)	SS-104	5/30/2018	0-2 ft BGS	160	1	180	1	270	1	27	0	0.93	0	9300	1
on-site (EU05-08)	SS-109	5/30/2018	0-2 ft BGS	37	1	40	1	67	1	29	0	0.99	0	9800	1
on-site (EU05-08)	SS-112	5/30/2018	0-2 ft BGS	9.3	1	6.3	1	9.1	1	24	0	0.83	0	4600	1
on-site (EU05-08)	SS-116	5/30/2018	0-2 ft BGS	34	1	35	1	55	1	22	0	0.76	0	1900	1
on-site (EU05-08)	SS-120	5/31/2018	0-2 ft BGS	130	1	100	1	170	1	44	0	1.5	0	1600	1
on-site (EU05-08)	SS-123	5/31/2018	0.3-2.3 ft BGS	940	1	880	1	1400	1	98	1	1.6	0	5100	1
on-site (EU05-08)	SS-158-AS	11/2/2018	0.25-0.75 ft BGS												
on-site (EU05-08)	SS-159-AS	11/2/2018	0.25-0.75 ft BGS												
on-site (EU05-08)	SS-160-AS	11/2/2018	0.17-0.67 ft BGS												

Table B.6.1

Summary of ProUCL Input Data for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23	24	25
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron	Manganese	D_Manganese	Nickel	D_Nickel
on-site (EU05-08)	SS-98	5/31/2018	0.17-2.17 ft BGS	5.2	1	0.27	0	5.6	1	960	1	18000	1	420	1	700	1
on-site (EU05-08)	SS-99	11/2/2018	0.25-2.25 ft BGS	9.8	1	0.28	0	4.2	1	13	1	16000	1	400	1	11	1
on-site (EU05-08)	SS-100	11/2/2018	0.17-2.17 ft BGS	7.7	1	0.285	0	4.55	1	30	1	12500	1	485	1	18	1
on-site (EU05-08)	SS-101	11/2/2018	0.25-2.25 ft BGS	5.9	1	0.28	0	4.2	1	17	1	12000	1	950	1	14	1
on-site (EU05-08)	SS-102	5/30/2018	0-2 ft BGS	7.05	1	0.44	1	4.35	1	19.5	1	11500	1	345	1	11	1
on-site (EU05-08)	SS-103	5/30/2018	0-2 ft BGS	20	1	0.29	0	7.7	1	37	1	11000	1	280	1	18	1
on-site (EU05-08)	SS-104	5/30/2018	0-2 ft BGS	33	1	1.5	1	12	1	40	1	12000	1	170	1	28	1
on-site (EU05-08)	SS-109	5/30/2018	0-2 ft BGS	59	1	0.36	0	9.3	1	38	1	15000	1	91	1	21	1
on-site (EU05-08)	SS-112	5/30/2018	0-2 ft BGS	28	1	0.9	1	7.8	1	24	1	10000	1	210	1	17	1
on-site (EU05-08)	SS-116	5/30/2018	0-2 ft BGS	5.5	1	0.29	1	4.8	1	17	1	4600	1	31	1	8.2	1
on-site (EU05-08)	SS-120	5/31/2018	0-2 ft BGS	6.6	1	0.89	1	3.8	1	15	1	5000	1	45	1	9.2	1
on-site (EU05-08)	SS-123	5/31/2018	0.3-2.3 ft BGS	5.4	1	0.29	0	3.6	1	14	1	11000	1	470	1	9.1	1
on-site (EU05-08)	SS-158-AS	11/2/2018	0.25-0.75 ft BGS														
on-site (EU05-08)	SS-159-AS	11/2/2018	0.25-0.75 ft BGS														
on-site (EU05-08)	SS-160-AS	11/2/2018	0.17-0.67 ft BGS														

Table B.6.1

Summary of ProUCL Input Data for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				26	27	28	29	30	31	32	33
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU05-08)	SS-98	5/31/2018	0.17-2.17 ft BGS	0.08	1	14	1	27	0	26	0
on-site (EU05-08)	SS-99	11/2/2018	0.25-2.25 ft BGS	0.34	1	17	1	400	1	27	0
on-site (EU05-08)	SS-100	11/2/2018	0.17-2.17 ft BGS	0.165	1	20	1	29	0	160	1
on-site (EU05-08)	SS-101	11/2/2018	0.25-2.25 ft BGS	0.14	1	45	1	27	0	26	0
on-site (EU05-08)	SS-102	5/30/2018	0-2 ft BGS	0.16	1	22	1	25.5	0	78	1
on-site (EU05-08)	SS-103	5/30/2018	0-2 ft BGS	0.59	1	31	1	29	0	87	1
on-site (EU05-08)	SS-104	5/30/2018	0-2 ft BGS	1.1	1	42	1	33	0	32	0
on-site (EU05-08)	SS-109	5/30/2018	0-2 ft BGS	2.7	1	44	1	37	0	35	0
on-site (EU05-08)	SS-112	5/30/2018	0-2 ft BGS	0.69	1	28	1	31	0	30	0
on-site (EU05-08)	SS-116	5/30/2018	0-2 ft BGS	0.063	1	11	1	28	0	27	0
on-site (EU05-08)	SS-120	5/31/2018	0-2 ft BGS	0.13	1	10	1	27	0	26	0
on-site (EU05-08)	SS-123	5/31/2018	0.3-2.3 ft BGS	0.1	1	16	1	30	0	29	0
on-site (EU05-08)	SS-158-AS	11/2/2018	0.25-0.75 ft BGS								
on-site (EU05-08)	SS-159-AS	11/2/2018	0.25-0.75 ft BGS								
on-site (EU05-08)	SS-160-AS	11/2/2018	0.17-0.67 ft BGS								

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	9.3	Mean	384.8
Maximum	1900	Median	160
SD	555.5	Std. Error of Mean	160.3
Coefficient of Variation	1.444	Skewness	2.197

Normal GOF Test

Shapiro Wilk Test Statistic	0.696	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.304	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	672.7	95% Adjusted-CLT UCL (Chen-1995)	757.2
		95% Modified-t UCL (Johnson-1978)	689.7

Gamma GOF Test

A-D Test Statistic	0.363	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.773	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.198	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.653	k star (bias corrected MLE)	0.545
Theta hat (MLE)	589.7	Theta star (bias corrected MLE)	706.1
nu hat (MLE)	15.66	nu star (bias corrected)	13.08
MLE Mean (bias corrected)	384.8	MLE Sd (bias corrected)	521.2
		Approximate Chi Square Value (0.05)	5.946
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	5.229

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	846.4	95% Adjusted Gamma UCL (use when n<50)	962.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.128	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.23	Mean of logged Data	5.017
Maximum of Logged Data	7.55	SD of logged Data	1.539

Assuming Lognormal Distribution

95% H-UCL	3122	90% Chebyshev (MVUE) UCL	1019
95% Chebyshev (MVUE) UCL	1293	97.5% Chebyshev (MVUE) UCL	1673
99% Chebyshev (MVUE) UCL	2419		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	648.5	95% Jackknife UCL	672.7
95% Standard Bootstrap UCL	635.6	95% Bootstrap-t UCL	1070
95% Hall's Bootstrap UCL	1508	95% Percentile Bootstrap UCL	659.6
95% BCA Bootstrap UCL	754.2		
90% Chebyshev(Mean, Sd) UCL	865.8	95% Chebyshev(Mean, Sd) UCL	1084
97.5% Chebyshev(Mean, Sd) UCL	1386	99% Chebyshev(Mean, Sd) UCL	1980

Suggested UCL to Use

95% Adjusted Gamma UCL	962.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	6.3	Mean	389.3
Maximum	1400	Median	180
SD	500.5	Std. Error of Mean	144.5
Coefficient of Variation	1.286	Skewness	1.41

Normal GOF Test

Shapiro Wilk Test Statistic	0.73	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.325	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	648.7	95% Adjusted-CLT UCL (Chen-1995)	689.8
		95% Modified-t UCL (Johnson-1978)	658.5

Gamma GOF Test

A-D Test Statistic	0.404	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.772	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.178	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.662	k star (bias corrected MLE)	0.552
Theta hat (MLE)	587.9	Theta star (bias corrected MLE)	705
nu hat (MLE)	15.89	nu star (bias corrected)	13.25
MLE Mean (bias corrected)	389.3	MLE Sd (bias corrected)	523.9
		Approximate Chi Square Value (0.05)	6.063
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	5.338

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	850.9	95% Adjusted Gamma UCL (use when n<50)	966.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.12	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.841	Mean of logged Data	5.044
Maximum of Logged Data	7.244	SD of logged Data	1.595

Assuming Lognormal Distribution

95% H-UCL	3964	90% Chebyshev (MVUE) UCL	1147
95% Chebyshev (MVUE) UCL	1460	97.5% Chebyshev (MVUE) UCL	1894
99% Chebyshev (MVUE) UCL	2747		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	626.9	95% Jackknife UCL	648.7
95% Standard Bootstrap UCL	615.7	95% Bootstrap-t UCL	859.6
95% Hall's Bootstrap UCL	618.5	95% Percentile Bootstrap UCL	641.7
95% BCA Bootstrap UCL	682.5		
90% Chebyshev(Mean, Sd) UCL	822.7	95% Chebyshev(Mean, Sd) UCL	1019
97.5% Chebyshev(Mean, Sd) UCL	1292	99% Chebyshev(Mean, Sd) UCL	1827

Suggested UCL to Use

95% Adjusted Gamma UCL	966.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	9.1	Mean	560
Maximum	1900	Median	270
SD	697.1	Std. Error of Mean	201.2
Coefficient of Variation	1.245	Skewness	1.299

Normal GOF Test

Shapiro Wilk Test Statistic	0.733	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.323	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	921.4	95% Adjusted-CLT UCL (Chen-1995)	971.7
		95% Modified-t UCL (Johnson-1978)	934

Gamma GOF Test

A-D Test Statistic	0.444	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.771	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.203	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.685	k star (bias corrected MLE)	0.569
Theta hat (MLE)	817.8	Theta star (bias corrected MLE)	983.9
nu hat (MLE)	16.44	nu star (bias corrected)	13.66
MLE Mean (bias corrected)	560	MLE Sd (bias corrected)	742.3
		Approximate Chi Square Value (0.05)	6.339
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	5.595

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1207	95% Adjusted Gamma UCL (use when n<50)	1367

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.124	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.208	Mean of logged Data	5.443
Maximum of Logged Data	7.55	SD of logged Data	1.575

Assuming Lognormal Distribution

95% H-UCL	5470	90% Chebyshev (MVUE) UCL	1653
95% Chebyshev (MVUE) UCL	2102	97.5% Chebyshev (MVUE) UCL	2725
99% Chebyshev (MVUE) UCL	3948		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	891	95% Jackknife UCL	921.4
95% Standard Bootstrap UCL	878.3	95% Bootstrap-t UCL	1093
95% Hall's Bootstrap UCL	829.8	95% Percentile Bootstrap UCL	892.6
95% BCA Bootstrap UCL	958.9		
90% Chebyshev(Mean, Sd) UCL	1164	95% Chebyshev(Mean, Sd) UCL	1437
97.5% Chebyshev(Mean, Sd) UCL	1817	99% Chebyshev(Mean, Sd) UCL	2562

Suggested UCL to Use

95% Adjusted Gamma UCL	1367

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
Number of Detects	5	Number of Non-Detects	7
Number of Distinct Detects	5	Number of Distinct Non-Detects	6
Minimum Detect	37	Minimum Non-Detect	21
Maximum Detect	320	Maximum Non-Detect	44
Variance Detects	13510	Percent Non-Detects	58.33%
Mean Detects	118.3	SD Detects	116.2
Median Detects	94	CV Detects	0.983
Skewness Detects	1.913	Kurtosis Detects	3.864
Mean of Logged Detects	4.451	SD of Logged Detects	0.86

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.751	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.369	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	61.93	KM Standard Error of Mean	26.59
KM SD	82.34	95% KM (BCA) UCL	103.9
95% KM (t) UCL	109.7	95% KM (Percentile Bootstrap) UCL	111
95% KM (z) UCL	105.7	95% KM Bootstrap t UCL	165.7
90% KM Chebyshev UCL	141.7	95% KM Chebyshev UCL	177.8
97.5% KM Chebyshev UCL	228	99% KM Chebyshev UCL	326.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.454	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.686	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.291	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.361	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.701	k star (bias corrected MLE)	0.814
Theta hat (MLE)	69.54	Theta star (bias corrected MLE)	145.4
nu hat (MLE)	17.01	nu star (bias corrected)	8.138
Mean (detects)	118.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	49.3
Maximum	320	Median	0.01
SD	92.86	CV	1.884
k hat (MLE)	0.161	k star (bias corrected MLE)	0.176
Theta hat (MLE)	306.5	Theta star (bias corrected MLE)	279.8
nu hat (MLE)	3.86	nu star (bias corrected)	4.229
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (4.23, α)	0.814	Adjusted Chi Square Value (4.23, β)	0.616
95% Gamma Approximate UCL (use when n>=50)	256.1	95% Gamma Adjusted UCL (use when n<50)	338.4

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	61.93	SD (KM)	82.34
Variance (KM)	6780	SE of Mean (KM)	26.59
k hat (KM)	0.566	k star (KM)	0.48
nu hat (KM)	13.58	nu star (KM)	11.52
theta hat (KM)	109.5	theta star (KM)	129.1
80% gamma percentile (KM)	101.5	90% gamma percentile (KM)	169
95% gamma percentile (KM)	241.4	99% gamma percentile (KM)	420.3

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.52, α)	4.91	Adjusted Chi Square Value (11.52, β)	4.271
95% Gamma Approximate KM-UCL (use when n>=50)	145.3	95% Gamma Adjusted KM-UCL (use when n<50)	167

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	53.95	Mean in Log Scale	3.041
SD in Original Scale	90.24	SD in Log Scale	1.37
95% t UCL (assumes normality of ROS data)	100.7	95% Percentile Bootstrap UCL	96.28
95% BCA Bootstrap UCL	118.6	95% Bootstrap t UCL	173.3
95% H-UCL (Log ROS)	239.6		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.644	KM Geo Mean	38.24
KM SD (logged)	0.849	95% Critical H Value (KM-Log)	2.651
KM Standard Error of Mean (logged)	0.275	95% H-UCL (KM -Log)	108.1
KM SD (logged)	0.849	95% Critical H Value (KM-Log)	2.651
KM Standard Error of Mean (logged)	0.275		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	57.17	Mean in Log Scale	3.355
SD in Original Scale	88.51	SD in Log Scale	1.115
95% t UCL (Assumes normality)	103.1	95% H-Stat UCL	152.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	165.7	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	167

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
Number of Detects	5	Number of Non-Detects	7
Number of Distinct Detects	5	Number of Distinct Non-Detects	7
Minimum Detect	22	Minimum Non-Detect	0.74
Maximum Detect	200	Maximum Non-Detect	1.6
Variance Detects	5181	Percent Non-Detects	58.33%
Mean Detects	88.4	SD Detects	71.98
Median Detects	62.5	CV Detects	0.814
Skewness Detects	1.107	Kurtosis Detects	0.439
Mean of Logged Detects	4.196	SD of Logged Detects	0.869

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	37.27	KM Standard Error of Mean	19.35
KM SD	59.96	95% KM (BCA) UCL	73.56
95% KM (t) UCL	72.02	95% KM (Percentile Bootstrap) UCL	68.7
95% KM (z) UCL	69.09	95% KM Bootstrap t UCL	87.04
90% KM Chebyshev UCL	95.32	95% KM Chebyshev UCL	121.6
97.5% KM Chebyshev UCL	158.1	99% KM Chebyshev UCL	229.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.204	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.685	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.18	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.361	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.899	k star (bias corrected MLE)	0.893
Theta hat (MLE)	46.56	Theta star (bias corrected MLE)	99.02
nu hat (MLE)	18.99	nu star (bias corrected)	8.928
Mean (detects)	88.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	36.84
Maximum	200	Median	0.01
SD	62.89	CV	1.707
k hat (MLE)	0.167	k star (bias corrected MLE)	0.18
Theta hat (MLE)	221.2	Theta star (bias corrected MLE)	204.1
nu hat (MLE)	3.997	nu star (bias corrected)	4.331
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (4.33, α)	0.857	Adjusted Chi Square Value (4.33, β)	0.651
95% Gamma Approximate UCL (use when n>=50)	186.3	95% Gamma Adjusted UCL (use when n<50)	245.1

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	37.27	SD (KM)	59.96
Variance (KM)	3595	SE of Mean (KM)	19.35
k hat (KM)	0.386	k star (KM)	0.345
nu hat (KM)	9.272	nu star (KM)	8.287
theta hat (KM)	96.46	theta star (KM)	107.9
80% gamma percentile (KM)	58.87	90% gamma percentile (KM)	107.8
95% gamma percentile (KM)	162.8	99% gamma percentile (KM)	303.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.29, α)	2.902	Adjusted Chi Square Value (8.29, β)	2.438
95% Gamma Approximate KM-UCL (use when n>=50)	106.4	95% Gamma Adjusted KM-UCL (use when n<50)	126.7

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.987	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.144	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	39.04	Mean in Log Scale	2.525
SD in Original Scale	61.5	SD in Log Scale	1.565
95% t UCL (assumes normality of ROS data)	70.93	95% Percentile Bootstrap UCL	68.68
95% BCA Bootstrap UCL	76.99	95% Bootstrap t UCL	117.6
95% H-UCL (Log ROS)	285.1		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.573	KM Geo Mean	4.82
KM SD (logged)	2.273	95% Critical H Value (KM-Log)	5.562
KM Standard Error of Mean (logged)	0.734	95% H-UCL (KM -Log)	2888
KM SD (logged)	2.273	95% Critical H Value (KM-Log)	5.562
KM Standard Error of Mean (logged)	0.734		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	37.14	Mean in Log Scale	1.347
SD in Original Scale	62.7	SD in Log Scale	2.58
95% t UCL (Assumes normality)	69.65	95% H-Stat UCL	13788

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	72.02

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	1600	Mean	5588
Maximum	9800	Median	5100
SD	2671	Std. Error of Mean	771.1
Coefficient of Variation	0.478	Skewness	0.375

Normal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6972	95% Adjusted-CLT UCL (Chen-1995)	6945
		95% Modified-t UCL (Johnson-1978)	6986

Gamma GOF Test

A-D Test Statistic	0.783	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.735	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.248	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.115	k star (bias corrected MLE)	3.142
Theta hat (MLE)	1358	Theta star (bias corrected MLE)	1778
nu hat (MLE)	98.77	nu star (bias corrected)	75.41
MLE Mean (bias corrected)	5588	MLE Sd (bias corrected)	3152
		Approximate Chi Square Value (0.05)	56.41
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	53.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7470	95% Adjusted Gamma UCL (use when n<50)	7816

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.847	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.378	Mean of logged Data	8.502
Maximum of Logged Data	9.19	SD of logged Data	0.563

Assuming Lognormal Distribution

95% H-UCL	8416	90% Chebyshev (MVUE) UCL	8541
95% Chebyshev (MVUE) UCL	9834	97.5% Chebyshev (MVUE) UCL	11629
99% Chebyshev (MVUE) UCL	15155		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6856	95% Jackknife UCL	6972
95% Standard Bootstrap UCL	6794	95% Bootstrap-t UCL	7150
95% Hall's Bootstrap UCL	7037	95% Percentile Bootstrap UCL	6792
95% BCA Bootstrap UCL	6908		
90% Chebyshev(Mean, Sd) UCL	7901	95% Chebyshev(Mean, Sd) UCL	8949
97.5% Chebyshev(Mean, Sd) UCL	10403	99% Chebyshev(Mean, Sd) UCL	13260

Suggested UCL to Use

95% Student's-t UCL	6972

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	5.2	Mean	16.1
Maximum	59	Median	7.375
SD	16.56	Std. Error of Mean	4.779
Coefficient of Variation	1.029	Skewness	1.884

Normal GOF Test

Shapiro Wilk Test Statistic	0.716	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.315	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	24.68	95% Adjusted-CLT UCL (Chen-1995)	26.73
		95% Modified-t UCL (Johnson-1978)	25.11

Gamma GOF Test

A-D Test Statistic	1.085	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.746	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.279	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.25	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.489	k star (bias corrected MLE)	1.173
Theta hat (MLE)	10.81	Theta star (bias corrected MLE)	13.73
nu hat (MLE)	35.74	nu star (bias corrected)	28.14
MLE Mean (bias corrected)	16.1	MLE Sd (bias corrected)	14.86
		Approximate Chi Square Value (0.05)	17.04
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	15.73

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	26.59	95% Adjusted Gamma UCL (use when n<50)	28.79

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.832	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.649	Mean of logged Data	2.407
Maximum of Logged Data	4.078	SD of logged Data	0.842

Assuming Lognormal Distribution

95% H-UCL	30.89	90% Chebyshev (MVUE) UCL	26.96
95% Chebyshev (MVUE) UCL	32.27	97.5% Chebyshev (MVUE) UCL	39.64
99% Chebyshev (MVUE) UCL	54.11		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	23.96	95% Jackknife UCL	24.68
95% Standard Bootstrap UCL	23.46	95% Bootstrap-t UCL	31.71
95% Hall's Bootstrap UCL	28.03	95% Percentile Bootstrap UCL	23.73
95% BCA Bootstrap UCL	27.24		
90% Chebyshev(Mean, Sd) UCL	30.43	95% Chebyshev(Mean, Sd) UCL	36.93
97.5% Chebyshev(Mean, Sd) UCL	45.94	99% Chebyshev(Mean, Sd) UCL	63.65

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	36.93

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	5	Number of Non-Detects	7
Number of Distinct Detects	5	Number of Distinct Non-Detects	5
Minimum Detect	0.29	Minimum Non-Detect	0.27
Maximum Detect	1.5	Maximum Non-Detect	0.36
Variance Detects	0.224	Percent Non-Detects	58.33%
Mean Detects	0.804	SD Detects	0.474
Median Detects	0.89	CV Detects	0.589
Skewness Detects	0.606	Kurtosis Detects	-0.00514
Mean of Logged Detects	-0.375	SD of Logged Detects	0.65

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.493	KM Standard Error of Mean	0.122
KM SD	0.379	95% KM (BCA) UCL	0.698
95% KM (t) UCL	0.713	95% KM (Percentile Bootstrap) UCL	0.688
95% KM (z) UCL	0.694	95% KM Bootstrap t UCL	0.782
90% KM Chebyshev UCL	0.86	95% KM Chebyshev UCL	1.027
97.5% KM Chebyshev UCL	1.258	99% KM Chebyshev UCL	1.711

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.287	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.682	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.359	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.344	k star (bias corrected MLE)	1.471
Theta hat (MLE)	0.24	Theta star (bias corrected MLE)	0.547
nu hat (MLE)	33.44	nu star (bias corrected)	14.71
Mean (detects)	0.804		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.341
Maximum	1.5	Median	0.01
SD	0.499	CV	1.463
k hat (MLE)	0.376	k star (bias corrected MLE)	0.338
Theta hat (MLE)	0.906	Theta star (bias corrected MLE)	1.009
nu hat (MLE)	9.03	nu star (bias corrected)	8.106
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (8.11, α)	2.797	Adjusted Chi Square Value (8.11, β)	2.343
95% Gamma Approximate UCL (use when n>=50)	0.988	95% Gamma Adjusted UCL (use when n<50)	1.179

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.493	SD (KM)	0.379
Variance (KM)	0.144	SE of Mean (KM)	0.122
k hat (KM)	1.686	k star (KM)	1.32
nu hat (KM)	40.46	nu star (KM)	31.68
theta hat (KM)	0.292	theta star (KM)	0.373
80% gamma percentile (KM)	0.773	90% gamma percentile (KM)	1.059
95% gamma percentile (KM)	1.34	99% gamma percentile (KM)	1.98

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (31.68, α)	19.82	Adjusted Chi Square Value (31.68, β)	18.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.788	95% Gamma Adjusted KM-UCL (use when n<50)	0.848

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.254	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.394	Mean in Log Scale	-1.522
SD in Original Scale	0.462	SD in Log Scale	1.113
95% t UCL (assumes normality of ROS data)	0.633	95% Percentile Bootstrap UCL	0.601
95% BCA Bootstrap UCL	0.678	95% Bootstrap t UCL	0.785
95% H-UCL (Log ROS)	1.156		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.919	KM Geo Mean	0.399
KM SD (logged)	0.594	95% Critical H Value (KM-Log)	2.262
KM Standard Error of Mean (logged)	0.192	95% H-UCL (KM -Log)	0.713
KM SD (logged)	0.594	95% Critical H Value (KM-Log)	2.262
KM Standard Error of Mean (logged)	0.192		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.421	Mean in Log Scale	-1.278
SD in Original Scale	0.443	SD in Log Scale	0.891
95% t UCL (Assumes normality)	0.65	95% H-Stat UCL	0.861

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.713

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	3.6	Mean	5.992
Maximum	12	Median	4.675
SD	2.638	Std. Error of Mean	0.761
Coefficient of Variation	0.44	Skewness	1.303

Normal GOF Test

Shapiro Wilk Test Statistic	0.826	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7.359	95% Adjusted-CLT UCL (Chen-1995)	7.55
		95% Modified-t UCL (Johnson-1978)	7.407

Gamma GOF Test

A-D Test Statistic	0.747	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.248	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.746	k star (bias corrected MLE)	5.115
Theta hat (MLE)	0.888	Theta star (bias corrected MLE)	1.171
nu hat (MLE)	161.9	nu star (bias corrected)	122.8
MLE Mean (bias corrected)	5.992	MLE Sd (bias corrected)	2.649
		Approximate Chi Square Value (0.05)	98.17
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	94.82

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7.492	95% Adjusted Gamma UCL (use when n<50)	7.757

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.228	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.281	Mean of logged Data	1.714
Maximum of Logged Data	2.485	SD of logged Data	0.392

Assuming Lognormal Distribution

95% H-UCL	7.612	90% Chebyshev (MVUE) UCL	8.009
95% Chebyshev (MVUE) UCL	8.939	97.5% Chebyshev (MVUE) UCL	10.23
99% Chebyshev (MVUE) UCL	12.76		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7.244	95% Jackknife UCL	7.359
95% Standard Bootstrap UCL	7.149	95% Bootstrap-t UCL	8.075
95% Hall's Bootstrap UCL	7.504	95% Percentile Bootstrap UCL	7.325
95% BCA Bootstrap UCL	7.55		
90% Chebyshev(Mean, Sd) UCL	8.276	95% Chebyshev(Mean, Sd) UCL	9.311
97.5% Chebyshev(Mean, Sd) UCL	10.75	99% Chebyshev(Mean, Sd) UCL	13.57

Suggested UCL to Use

95% Student's-t UCL	7.359	or 95% Modified-t UCL	7.407
or 95% H-UCL	7.612		

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	13	Mean	102
Maximum	960	Median	21.75
SD	270.4	Std. Error of Mean	78.05
Coefficient of Variation	2.65	Skewness	3.456

Normal GOF Test

Shapiro Wilk Test Statistic	0.359	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.507	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	242.2	95% Adjusted-CLT UCL (Chen-1995)	313.6
		95% Modified-t UCL (Johnson-1978)	255.2

Gamma GOF Test

A-D Test Statistic	2.737	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.783	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.456	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.258	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.52	k star (bias corrected MLE)	0.445
Theta hat (MLE)	196.3	Theta star (bias corrected MLE)	229.1
nu hat (MLE)	12.48	nu star (bias corrected)	10.69
MLE Mean (bias corrected)	102	MLE Sd (bias corrected)	152.9
		Approximate Chi Square Value (0.05)	4.379
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	3.782

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	249.2	95% Adjusted Gamma UCL (use when n<50)	288.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.65	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.322	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.565	Mean of logged Data	3.411
Maximum of Logged Data	6.867	SD of logged Data	1.161

Assuming Lognormal Distribution

95% H-UCL	183.3	90% Chebyshev (MVUE) UCL	114.3
95% Chebyshev (MVUE) UCL	141.2	97.5% Chebyshev (MVUE) UCL	178.7
99% Chebyshev (MVUE) UCL	252.2		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	230.4	95% Jackknife UCL	242.2
95% Standard Bootstrap UCL	227.3	95% Bootstrap-t UCL	2653
95% Hall's Bootstrap UCL	1314	95% Percentile Bootstrap UCL	257.3
95% BCA Bootstrap UCL	336.1		
90% Chebyshev(Mean, Sd) UCL	336.2	95% Chebyshev(Mean, Sd) UCL	442.2
97.5% Chebyshev(Mean, Sd) UCL	589.5	99% Chebyshev(Mean, Sd) UCL	878.6

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	442.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	4600	Mean	11550
Maximum	18000	Median	11750
SD	3918	Std. Error of Mean	1131
Coefficient of Variation	0.339	Skewness	-0.403

Normal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	13581	95% Adjusted-CLT UCL (Chen-1995)	13270
		95% Modified-t UCL (Johnson-1978)	13559

Gamma GOF Test

A-D Test Statistic	0.75	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.246	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.503	k star (bias corrected MLE)	5.683
Theta hat (MLE)	1539	Theta star (bias corrected MLE)	2033
nu hat (MLE)	180.1	nu star (bias corrected)	136.4
MLE Mean (bias corrected)	11550	MLE Sd (bias corrected)	4845
		Approximate Chi Square Value (0.05)	110.4
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	106.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	14268	95% Adjusted Gamma UCL (use when n<50)	14744

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.834	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.269	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.434	Mean of logged Data	9.286
Maximum of Logged Data	9.798	SD of logged Data	0.415

Assuming Lognormal Distribution

95% H-UCL	15192	90% Chebyshev (MVUE) UCL	15943
95% Chebyshev (MVUE) UCL	17878	97.5% Chebyshev (MVUE) UCL	20563
99% Chebyshev (MVUE) UCL	25838		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13410	95% Jackknife UCL	13581
95% Standard Bootstrap UCL	13313	95% Bootstrap-t UCL	13417
95% Hall's Bootstrap UCL	13500	95% Percentile Bootstrap UCL	13292
95% BCA Bootstrap UCL	13208		
90% Chebyshev(Mean, Sd) UCL	14943	95% Chebyshev(Mean, Sd) UCL	16480
97.5% Chebyshev(Mean, Sd) UCL	18613	99% Chebyshev(Mean, Sd) UCL	22803

Suggested UCL to Use

95% Student's-t UCL	13581

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	31	Mean	324.8
Maximum	950	Median	312.5
SD	254.3	Std. Error of Mean	73.4
Coefficient of Variation	0.783	Skewness	1.245

Normal GOF Test

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	456.6	95% Adjusted-CLT UCL (Chen-1995)	473.7
		95% Modified-t UCL (Johnson-1978)	461

Gamma GOF Test

A-D Test Statistic	0.3	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.137	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.49	k star (bias corrected MLE)	1.173
Theta hat (MLE)	217.9	Theta star (bias corrected MLE)	276.8
nu hat (MLE)	35.77	nu star (bias corrected)	28.16
MLE Mean (bias corrected)	324.8	MLE Sd (bias corrected)	299.8
		Approximate Chi Square Value (0.05)	17.05
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	15.75

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	536.3	95% Adjusted Gamma UCL (use when n<50)	580.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.169	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.434	Mean of logged Data	5.411
Maximum of Logged Data	6.856	SD of logged Data	1.026

Assuming Lognormal Distribution

95% H-UCL	947.9	90% Chebyshev (MVUE) UCL	696.7
95% Chebyshev (MVUE) UCL	850.6	97.5% Chebyshev (MVUE) UCL	1064
99% Chebyshev (MVUE) UCL	1484		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	445.5	95% Jackknife UCL	456.6
95% Standard Bootstrap UCL	438.2	95% Bootstrap-t UCL	502.7
95% Hall's Bootstrap UCL	559.4	95% Percentile Bootstrap UCL	448.3
95% BCA Bootstrap UCL	473.8		
90% Chebyshev(Mean, Sd) UCL	545	95% Chebyshev(Mean, Sd) UCL	644.7
97.5% Chebyshev(Mean, Sd) UCL	783.1	99% Chebyshev(Mean, Sd) UCL	1055

Suggested UCL to Use

95% Student's-t UCL	456.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	8.2	Mean	72.04
Maximum	700	Median	15.5
SD	197.8	Std. Error of Mean	57.11
Coefficient of Variation	2.746	Skewness	3.459

Normal GOF Test

Shapiro Wilk Test Statistic	0.353	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.505	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	174.6	95% Adjusted-CLT UCL (Chen-1995)	226.9
		95% Modified-t UCL (Johnson-1978)	184.1

Gamma GOF Test

A-D Test Statistic	2.906	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.788	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.443	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.259	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.484	k star (bias corrected MLE)	0.419
Theta hat (MLE)	148.8	Theta star (bias corrected MLE)	172
nu hat (MLE)	11.62	nu star (bias corrected)	10.05
MLE Mean (bias corrected)	72.04	MLE Sd (bias corrected)	111.3
		Approximate Chi Square Value (0.05)	3.973
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	3.41

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	182.2	95% Adjusted Gamma UCL (use when n<50)	212.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.627	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.305	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.104	Mean of logged Data	2.959
Maximum of Logged Data	6.551	SD of logged Data	1.193

Assuming Lognormal Distribution

95% H-UCL	127.6	90% Chebyshev (MVUE) UCL	76.14
95% Chebyshev (MVUE) UCL	94.36	97.5% Chebyshev (MVUE) UCL	119.6
99% Chebyshev (MVUE) UCL	169.3		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	166	95% Jackknife UCL	174.6
95% Standard Bootstrap UCL	161.1	95% Bootstrap-t UCL	2744
95% Hall's Bootstrap UCL	1160	95% Percentile Bootstrap UCL	186.1
95% BCA Bootstrap UCL	242.8		
90% Chebyshev(Mean, Sd) UCL	243.4	95% Chebyshev(Mean, Sd) UCL	321
97.5% Chebyshev(Mean, Sd) UCL	428.7	99% Chebyshev(Mean, Sd) UCL	640.3

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	321

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.063	Mean	0.522
Maximum	2.7	Median	0.163
SD	0.756	Std. Error of Mean	0.218
Coefficient of Variation	1.45	Skewness	2.542

Normal GOF Test

Shapiro Wilk Test Statistic	0.645	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.272	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.913	95% Adjusted-CLT UCL (Chen-1995)	1.052
		95% Modified-t UCL (Johnson-1978)	0.94

Gamma GOF Test

A-D Test Statistic	0.752	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.762	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.276	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.254	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.85	k star (bias corrected MLE)	0.693
Theta hat (MLE)	0.613	Theta star (bias corrected MLE)	0.752
nu hat (MLE)	20.41	nu star (bias corrected)	16.64
MLE Mean (bias corrected)	0.522	MLE Sd (bias corrected)	0.626
		Approximate Chi Square Value (0.05)	8.414
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	7.538

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1.031	95% Adjusted Gamma UCL (use when n<50)	1.151

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.237	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.765	Mean of logged Data	-1.344
Maximum of Logged Data	0.993	SD of logged Data	1.163

Assuming Lognormal Distribution

95% H-UCL	1.585	90% Chebyshev (MVUE) UCL	0.986
95% Chebyshev (MVUE) UCL	1.219	97.5% Chebyshev (MVUE) UCL	1.542
99% Chebyshev (MVUE) UCL	2.177		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.88	95% Jackknife UCL	0.913
95% Standard Bootstrap UCL	0.863	95% Bootstrap-t UCL	1.672
95% Hall's Bootstrap UCL	2.233	95% Percentile Bootstrap UCL	0.932
95% BCA Bootstrap UCL	1.092		
90% Chebyshev(Mean, Sd) UCL	1.176	95% Chebyshev(Mean, Sd) UCL	1.473
97.5% Chebyshev(Mean, Sd) UCL	1.884	99% Chebyshev(Mean, Sd) UCL	2.693

Suggested UCL to Use

95% Adjusted Gamma UCL	1.151

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	10	Mean	25
Maximum	45	Median	21
SD	12.85	Std. Error of Mean	3.709
Coefficient of Variation	0.514	Skewness	0.575

Normal GOF Test

Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	31.66	95% Adjusted-CLT UCL (Chen-1995)	31.76
		95% Modified-t UCL (Johnson-1978)	31.76

Gamma GOF Test

A-D Test Statistic	0.352	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.16	k star (bias corrected MLE)	3.176
Theta hat (MLE)	6.009	Theta star (bias corrected MLE)	7.872
nu hat (MLE)	99.85	nu star (bias corrected)	76.22
MLE Mean (bias corrected)	25	MLE Sd (bias corrected)	14.03
		Approximate Chi Square Value (0.05)	57.11
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	54.59

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	33.37	95% Adjusted Gamma UCL (use when n<50)	34.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.937	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.303	Mean of logged Data	3.094
Maximum of Logged Data	3.807	SD of logged Data	0.528

Assuming Lognormal Distribution

95% H-UCL	35.88	90% Chebyshev (MVUE) UCL	36.8
95% Chebyshev (MVUE) UCL	42.12	97.5% Chebyshev (MVUE) UCL	49.51
99% Chebyshev (MVUE) UCL	64.03		

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	31.1	95% Jackknife UCL	31.66
95% Standard Bootstrap UCL	30.78	95% Bootstrap-t UCL	32.48
95% Hall's Bootstrap UCL	30.59	95% Percentile Bootstrap UCL	31.17
95% BCA Bootstrap UCL	31.08		
90% Chebyshev(Mean, Sd) UCL	36.13	95% Chebyshev(Mean, Sd) UCL	41.17
97.5% Chebyshev(Mean, Sd) UCL	48.16	99% Chebyshev(Mean, Sd) UCL	61.91

Suggested UCL to Use

95% Student's-t UCL	31.66

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	1	Number of Non-Detects	11
Number of Distinct Detects	1	Number of Distinct Non-Detects	8

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1248 (PCB-1248) was not processed!

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
Number of Detects	3	Number of Non-Detects	9
Number of Distinct Detects	3	Number of Distinct Non-Detects	6
Minimum Detect	78	Minimum Non-Detect	26
Maximum Detect	160	Maximum Non-Detect	35
Variance Detects	2022	Percent Non-Detects	75%
Mean Detects	108.3	SD Detects	44.97
Median Detects	87	CV Detects	0.415
Skewness Detects	1.654	Kurtosis Detects	N/A
Mean of Logged Detects	4.633	SD of Logged Detects	0.387

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.831	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.349	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	46.58	KM Standard Error of Mean	14.18
KM SD	40.1	95% KM (BCA) UCL	N/A
95% KM (t) UCL	72.04	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	69.9	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	89.12	95% KM Chebyshev UCL	108.4
97.5% KM Chebyshev UCL	135.1	99% KM Chebyshev UCL	187.7

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	9.666	k star (bias corrected MLE)	N/A
Theta hat (MLE)	11.21	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	58	nu star (bias corrected)	N/A
Mean (detects)	108.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	27.09
Maximum	160	Median	0.01
SD	52.61	CV	1.942
k hat (MLE)	0.139	k star (bias corrected MLE)	0.16
Theta hat (MLE)	195	Theta star (bias corrected MLE)	169.6
nu hat (MLE)	3.334	nu star (bias corrected)	3.833
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (3.83, α)	0.657	Adjusted Chi Square Value (3.83, β)	0.488
95% Gamma Approximate UCL (use when n>=50)	158.1	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.6.2

Summary of ProUCL Output for EU05-EU08 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/22/2019 3:04:28 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	46.58	SD (KM)	40.1
Variance (KM)	1608	SE of Mean (KM)	14.18
k hat (KM)	1.349	k star (KM)	1.068
nu hat (KM)	32.39	nu star (KM)	25.62
theta hat (KM)	34.52	theta star (KM)	43.63
80% gamma percentile (KM)	74.56	90% gamma percentile (KM)	105.5
95% gamma percentile (KM)	136.4	99% gamma percentile (KM)	207.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.62, α)	15.09	Adjusted Chi Square Value (25.62, β)	13.87
95% Gamma Approximate KM-UCL (use when n>=50)	79.1	95% Gamma Adjusted KM-UCL (use when n<50)	86.07

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.861	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.333	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	41.31	Mean in Log Scale	3.324
SD in Original Scale	45.09	SD in Log Scale	0.862
95% t UCL (assumes normality of ROS data)	64.68	95% Percentile Bootstrap UCL	63.83
95% BCA Bootstrap UCL	69.62	95% Bootstrap t UCL	87.38
95% H-UCL (Log ROS)	80.6		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.602	KM Geo Mean	36.66
KM SD (logged)	0.616	95% Critical H Value (KM-Log)	2.293
KM Standard Error of Mean (logged)	0.218	95% H-UCL (KM -Log)	67.83
KM SD (logged)	0.616	95% Critical H Value (KM-Log)	2.293
KM Standard Error of Mean (logged)	0.218		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	37.83	Mean in Log Scale	3.151
SD in Original Scale	46.66	SD in Log Scale	0.913
95% t UCL (Assumes normality)	62.02	95% H-Stat UCL	75.77

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	72.04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.3

Summary of ProUCL Input Data for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Aluminum	D_Aluminum
on-site (EU05-08)	SS-98	5/31/2018	0.17-2.17 ft BGS	47	1	70	1	94	1	21	0	0.74	0	5500	1
on-site (EU05-08)	SS-99	11/2/2018	0.25-2.25 ft BGS	160	1	180	1	280	1	22	0	40	1	5200	1
on-site (EU05-08)	SS-100	11/2/2018	0.17-2.17 ft BGS	335	1	295	1	455	1	42.5	1	62.5	1	4750	1
on-site (EU05-08)	SS-101	11/2/2018	0.25-2.25 ft BGS	1900	1	1400	1	1900	1	320	1	200	1	5100	1
on-site (EU05-08)	SS-102	5/30/2018	0-2 ft BGS	675	1	1275	1	1750	1	94	1	117.5	1	4800	1
on-site (EU05-08)	SS-103	5/30/2018	0-2 ft BGS	190	1	210	1	270	1	37	1	22	1	9400	1
on-site (EU05-08)	SS-104	5/30/2018	0-2 ft BGS	160	1	180	1	270	1	27	0	0.93	0	9300	1
on-site (EU05-08)	SS-109	5/30/2018	0-2 ft BGS	37	1	40	1	67	1	29	0	0.99	0	9800	1
on-site (EU05-08)	SS-112	5/30/2018	0-2 ft BGS	9.3	1	6.3	1	9.1	1	24	0	0.83	0	4600	1
on-site (EU05-08)	SS-116	5/30/2018	0-2 ft BGS	34	1	35	1	55	1	22	0	0.76	0	1900	1
on-site (EU05-08)	SS-120	5/31/2018	0-2 ft BGS	130	1	100	1	170	1	44	0	1.5	0	1600	1
on-site (EU05-08)	SS-123	5/31/2018	0.3-2.3 ft BGS	940	1	880	1	1400	1	98	1	1.6	0	5100	1
on-site (EU05-08)	SS-158-AS	11/2/2018	0.25-0.75 ft BGS												
on-site (EU05-08)	SS-159-AS	11/2/2018	0.25-0.75 ft BGS												
on-site (EU05-08)	SS-160-AS	11/2/2018	0.17-0.67 ft BGS												
on-site (EU05-08)	BH122-18	5/31/2018	6-8 ft BGS	26	1	40	1	65	1	21	0	0.72	0	3800	1
on-site (EU05-08)	BH125-18	5/30/2018	7-9 ft BGS	390	1	370	1	550	1	50	1	68	1	9300	1
on-site (EU05-08)	BH126-18	5/30/2018	10-12 ft BGS	760	1	790	1	1200	1	98	1	87	1	5800	1
on-site (EU05-08)	BH127-18	5/30/2018	7-9 ft BGS	8	1	10	1	13	1	22	0	0.78	0	12000	1
on-site (EU05-08)	BH128-18	5/30/2018	13-15 ft BGS	750	1	840	1	950	1	230	1	120	1	4000	1
on-site (EU05-08)	BH129-18	5/30/2018	13-15 ft BGS	190	1	200	1	230	1	99	0	3.4	0	3400	1
on-site (EU05-08)	BH130-18	5/30/2018	9.5-11.5 ft BGS	24	1	27	1	41	1	22	0	0.76	0	8000	1
on-site (EU05-08)	BH132-18	5/31/2018	6.5-8.5 ft BGS	41	1	27	1	43	1	43	0	1.5	0	11000	1
on-site (EU05-08)	BH133-18	5/31/2018	7-9 ft BGS	0.72	0	5.1	1	8.5	1	22	0	0.75	0	8000	1

Table B.6.3

Summary of ProUCL Input Data for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23	24	25
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Antimony	D_Antimony	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron	Manganese	D_Manganese
on-site (EU05-08)	SS-98	5/31/2018	0.17-2.17 ft BGS	1.2	1	5.2	1	0.27	0	5.6	1	960	1	18000	1	420	1
on-site (EU05-08)	SS-99	11/2/2018	0.25-2.25 ft BGS	0.24	1	9.8	1	0.28	0	4.2	1	13	1	16000	1	400	1
on-site (EU05-08)	SS-100	11/2/2018	0.17-2.17 ft BGS	0.39	1	7.7	1	0.285	0	4.55	1	30	1	12500	1	485	1
on-site (EU05-08)	SS-101	11/2/2018	0.25-2.25 ft BGS	0.21	1	5.9	1	0.28	0	4.2	1	17	1	12000	1	950	1
on-site (EU05-08)	SS-102	5/30/2018	0-2 ft BGS	0.24	1	7.05	1	0.44	1	4.35	1	19.5	1	11500	1	345	1
on-site (EU05-08)	SS-103	5/30/2018	0-2 ft BGS	0.56	1	20	1	0.29	0	7.7	1	37	1	11000	1	280	1
on-site (EU05-08)	SS-104	5/30/2018	0-2 ft BGS	0.66	1	33	1	1.5	1	12	1	40	1	12000	1	170	1
on-site (EU05-08)	SS-109	5/30/2018	0-2 ft BGS	0.6	1	59	1	0.36	0	9.3	1	38	1	15000	1	91	1
on-site (EU05-08)	SS-112	5/30/2018	0-2 ft BGS	0.45	1	28	1	0.9	1	7.8	1	24	1	10000	1	210	1
on-site (EU05-08)	SS-116	5/30/2018	0-2 ft BGS	0.14	0	5.5	1	0.29	1	4.8	1	17	1	4600	1	31	1
on-site (EU05-08)	SS-120	5/31/2018	0-2 ft BGS	0.14	0	6.6	1	0.89	1	3.8	1	15	1	5000	1	45	1
on-site (EU05-08)	SS-123	5/31/2018	0.3-2.3 ft BGS	0.2	1	5.4	1	0.29	0	3.6	1	14	1	11000	1	470	1
on-site (EU05-08)	SS-158-AS	11/2/2018	0.25-0.75 ft BGS														
on-site (EU05-08)	SS-159-AS	11/2/2018	0.25-0.75 ft BGS														
on-site (EU05-08)	SS-160-AS	11/2/2018	0.17-0.67 ft BGS														
on-site (EU05-08)	BH122-18	5/31/2018	6-8 ft BGS	0.49	1	5.4	1	0.27	0	5.2	1	240	1	13000	1	330	1
on-site (EU05-08)	BH125-18	5/30/2018	7-9 ft BGS	5.4	1	19	1	0.28	0	7.9	1	120	1	21000	1	690	1
on-site (EU05-08)	BH126-18	5/30/2018	10-12 ft BGS	0.75	1	9.2	1	0.91	1	4.3	1	41	1	9800	1	250	1
on-site (EU05-08)	BH127-18	5/30/2018	7-9 ft BGS	0.2	1	11	1	0.57	0	8.9	1	23	1	23000	1	610	1
on-site (EU05-08)	BH128-18	5/30/2018	13-15 ft BGS	0.28	1	4.2	1	0.43	1	2.4	1	9.9	1	4300	1	110	1
on-site (EU05-08)	BH129-18	5/30/2018	13-15 ft BGS	0.16	1	5	1	0.96	1	3	1	15	1	7600	1	220	1
on-site (EU05-08)	BH130-18	5/30/2018	9.5-11.5 ft BGS	0.32	1	9.6	1	0.28	0	7.3	1	17	1	16000	1	1000	1
on-site (EU05-08)	BH132-18	5/31/2018	6.5-8.5 ft BGS	0.25	0	6.5	1	7.5	1	3.7	1	14	1	11000	1	290	1
on-site (EU05-08)	BH133-18	5/31/2018	7-9 ft BGS	0.35	1	7.8	1	0.28	0	6.2	1	33	1	21000	1	570	1

Table B.6.3

Summary of ProUCL Input Data for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				26	27	28	29	30	31	32	33	34	35
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Nickel	D_Nickel	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU05-08)	SS-98	5/31/2018	0.17-2.17 ft BGS	700	1	0.08	1	14	1	27	0	26	0
on-site (EU05-08)	SS-99	11/2/2018	0.25-2.25 ft BGS	11	1	0.34	1	17	1	400	1	27	0
on-site (EU05-08)	SS-100	11/2/2018	0.17-2.17 ft BGS	18	1	0.165	1	20	1	29	0	160	1
on-site (EU05-08)	SS-101	11/2/2018	0.25-2.25 ft BGS	14	1	0.14	1	45	1	27	0	26	0
on-site (EU05-08)	SS-102	5/30/2018	0-2 ft BGS	11	1	0.16	1	22	1	25.5	0	78	1
on-site (EU05-08)	SS-103	5/30/2018	0-2 ft BGS	18	1	0.59	1	31	1	29	0	87	1
on-site (EU05-08)	SS-104	5/30/2018	0-2 ft BGS	28	1	1.1	1	42	1	33	0	32	0
on-site (EU05-08)	SS-109	5/30/2018	0-2 ft BGS	21	1	2.7	1	44	1	37	0	35	0
on-site (EU05-08)	SS-112	5/30/2018	0-2 ft BGS	17	1	0.69	1	28	1	31	0	30	0
on-site (EU05-08)	SS-116	5/30/2018	0-2 ft BGS	8.2	1	0.063	1	11	1	28	0	27	0
on-site (EU05-08)	SS-120	5/31/2018	0-2 ft BGS	9.2	1	0.13	1	10	1	27	0	26	0
on-site (EU05-08)	SS-123	5/31/2018	0.3-2.3 ft BGS	9.1	1	0.1	1	16	1	30	0	29	0
on-site (EU05-08)	SS-158-AS	11/2/2018	0.25-0.75 ft BGS										
on-site (EU05-08)	SS-159-AS	11/2/2018	0.25-0.75 ft BGS										
on-site (EU05-08)	SS-160-AS	11/2/2018	0.17-0.67 ft BGS										
on-site (EU05-08)	BH122-18	5/31/2018	6-8 ft BGS	470	1	0.12	1	10	1	74	1	26	0
on-site (EU05-08)	BH125-18	5/30/2018	7-9 ft BGS	27	1	0.25	1	27	1	28	0	27	0
on-site (EU05-08)	BH126-18	5/30/2018	10-12 ft BGS	11	1	0.18	1	16	1	26	0	25	0
on-site (EU05-08)	BH127-18	5/30/2018	7-9 ft BGS	20	1	0.2	1	30	1	28	0	27	0
on-site (EU05-08)	BH128-18	5/30/2018	13-15 ft BGS	13	1	0.11	1	26	1	37	0	36	0
on-site (EU05-08)	BH129-18	5/30/2018	13-15 ft BGS	9.3	1	0.1	1	25	1	25	0	54	1
on-site (EU05-08)	BH130-18	5/30/2018	9.5-11.5 ft BGS	13	1	0.17	1	22	1	28	0	27	0
on-site (EU05-08)	BH132-18	5/31/2018	6.5-8.5 ft BGS	13	1	0.095	0	24	1	52	0	50	0
on-site (EU05-08)	BH133-18	5/31/2018	7-9 ft BGS	24	1	0.15	1	23	1	28	0	27	0

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	21	Number of Distinct Observations	19
		Number of Missing Observations	3
Number of Detects	20	Number of Non-Detects	1
Number of Distinct Detects	18	Number of Distinct Non-Detects	1
Minimum Detect	8	Minimum Non-Detect	0.72
Maximum Detect	1900	Maximum Non-Detect	0.72
Variance Detects	220289	Percent Non-Detects	4.762%
Mean Detects	340.3	SD Detects	469.3
Median Detects	160	CV Detects	1.379
Skewness Detects	2.216	Kurtosis Detects	5.691
Mean of Logged Detects	4.845	SD of Logged Detects	1.596

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.717	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	324.1	KM Standard Error of Mean	101.3
KM SD	452.3	95% KM (BCA) UCL	507.6
95% KM (t) UCL	498.8	95% KM (Percentile Bootstrap) UCL	491.8
95% KM (z) UCL	490.7	95% KM Bootstrap t UCL	601.8
90% KM Chebyshev UCL	627.9	95% KM Chebyshev UCL	765.5
97.5% KM Chebyshev UCL	956.5	99% KM Chebyshev UCL	1332

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.462	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.791	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.166	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.203	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.624	k star (bias corrected MLE)	0.564
Theta hat (MLE)	545.5	Theta star (bias corrected MLE)	603.8
nu hat (MLE)	24.95	nu star (bias corrected)	22.54
Mean (detects)	340.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	324.1
Maximum	1900	Median	160
SD	463.5	CV	1.43
k hat (MLE)	0.464	k star (bias corrected MLE)	0.429
Theta hat (MLE)	698.9	Theta star (bias corrected MLE)	755.1
nu hat (MLE)	19.48	nu star (bias corrected)	18.03
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (18.03, α)	9.411	Adjusted Chi Square Value (18.03, β)	8.934
95% Gamma Approximate UCL (use when n>=50)	620.9	95% Gamma Adjusted UCL (use when n<50)	654

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	324.1	SD (KM)	452.3
Variance (KM)	204539	SE of Mean (KM)	101.3
k hat (KM)	0.514	k star (KM)	0.472
nu hat (KM)	21.57	nu star (KM)	19.83
theta hat (KM)	631	theta star (KM)	686.7
80% gamma percentile (KM)	530.8	90% gamma percentile (KM)	887.3
95% gamma percentile (KM)	1271	99% gamma percentile (KM)	2219

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (19.83, α)	10.72	Adjusted Chi Square Value (19.83, β)	10.21
95% Gamma Approximate KM-UCL (use when n>=50)	599.3	95% Gamma Adjusted KM-UCL (use when n<50)	629.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.133	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	324.2	Mean in Log Scale	4.657
SD in Original Scale	463.4	SD in Log Scale	1.778
95% t UCL (assumes normality of ROS data)	498.6	95% Percentile Bootstrap UCL	488.4
95% BCA Bootstrap UCL	551.9	95% Bootstrap t UCL	613.9
95% H-UCL (Log ROS)	2285		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.599	KM Geo Mean	99.36
KM SD (logged)	1.876	95% Critical H Value (KM-Log)	3.93
KM Standard Error of Mean (logged)	0.42	95% H-UCL (KM -Log)	2999
KM SD (logged)	1.876	95% Critical H Value (KM-Log)	3.93
KM Standard Error of Mean (logged)	0.42		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	324.1	Mean in Log Scale	4.566
SD in Original Scale	463.4	SD in Log Scale	2.015
95% t UCL (Assumes normality)	498.5	95% H-Stat UCL	4779

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	629.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	21	Number of Distinct Observations	18
		Number of Missing Observations	3
Minimum	5.1	Mean	332.4
Maximum	1400	Median	180
SD	433.8	Std. Error of Mean	94.66
Coefficient of Variation	1.305	Skewness	1.467

Normal GOF Test

Shapiro Wilk Test Statistic	0.748	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.278	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	495.7	95% Adjusted-CLT UCL (Chen-1995)	520.5
		95% Modified-t UCL (Johnson-1978)	500.7

Gamma GOF Test

A-D Test Statistic	0.47	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.798	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.147	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.199	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.578	k star (bias corrected MLE)	0.527
Theta hat (MLE)	575	Theta star (bias corrected MLE)	630.5
nu hat (MLE)	24.28	nu star (bias corrected)	22.14
MLE Mean (bias corrected)	332.4	MLE Sd (bias corrected)	457.8
		Approximate Chi Square Value (0.05)	12.45
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	11.89

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	591.4	95% Adjusted Gamma UCL (use when n<50)	619.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.129	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.629	Mean of logged Data	4.732
Maximum of Logged Data	7.244	SD of logged Data	1.723

Assuming Lognormal Distribution

95% H-UCL	2063	90% Chebyshev (MVUE) UCL	1029
95% Chebyshev (MVUE) UCL	1300	97.5% Chebyshev (MVUE) UCL	1676
99% Chebyshev (MVUE) UCL	2414		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	488.1	95% Jackknife UCL	495.7
95% Standard Bootstrap UCL	487	95% Bootstrap-t UCL	551.6
95% Hall's Bootstrap UCL	514.5	95% Percentile Bootstrap UCL	496.6
95% BCA Bootstrap UCL	520.6		
90% Chebyshev(Mean, Sd) UCL	616.4	95% Chebyshev(Mean, Sd) UCL	745
97.5% Chebyshev(Mean, Sd) UCL	923.5	99% Chebyshev(Mean, Sd) UCL	1274

Suggested UCL to Use

95% Adjusted Gamma UCL	619.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
		Number of Missing Observations	3
Minimum	8.5	Mean	467.6
Maximum	1900	Median	230
SD	600.9	Std. Error of Mean	131.1
Coefficient of Variation	1.285	Skewness	1.428

Normal GOF Test

Shapiro Wilk Test Statistic	0.754	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.289	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	693.8	95% Adjusted-CLT UCL (Chen-1995)	727
		95% Modified-t UCL (Johnson-1978)	700.6

Gamma GOF Test

A-D Test Statistic	0.432	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.797	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.134	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.199	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.597	k star (bias corrected MLE)	0.544
Theta hat (MLE)	783	Theta star (bias corrected MLE)	860.2
nu hat (MLE)	25.08	nu star (bias corrected)	22.83
MLE Mean (bias corrected)	467.6	MLE Sd (bias corrected)	634.2
		Approximate Chi Square Value (0.05)	12.97
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	12.39

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	823.6	95% Adjusted Gamma UCL (use when n<50)	861.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.1	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.14	Mean of logged Data	5.112
Maximum of Logged Data	7.55	SD of logged Data	1.689

Assuming Lognormal Distribution

95% H-UCL	2714	90% Chebyshev (MVUE) UCL	1415
95% Chebyshev (MVUE) UCL	1784	97.5% Chebyshev (MVUE) UCL	2296
99% Chebyshev (MVUE) UCL	3302		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	683.3	95% Jackknife UCL	693.8
95% Standard Bootstrap UCL	682.7	95% Bootstrap-t UCL	767.4
95% Hall's Bootstrap UCL	707.2	95% Percentile Bootstrap UCL	696.4
95% BCA Bootstrap UCL	704.8		
90% Chebyshev(Mean, Sd) UCL	861	95% Chebyshev(Mean, Sd) UCL	1039
97.5% Chebyshev(Mean, Sd) UCL	1287	99% Chebyshev(Mean, Sd) UCL	1772

Suggested UCL to Use

95% Adjusted Gamma UCL	861.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	21	Number of Distinct Observations	15
		Number of Missing Observations	3
Number of Detects	8	Number of Non-Detects	13
Number of Distinct Detects	7	Number of Distinct Non-Detects	8
Minimum Detect	37	Minimum Non-Detect	21
Maximum Detect	320	Maximum Non-Detect	99
Variance Detects	10218	Percent Non-Detects	61.9%
Mean Detects	121.2	SD Detects	101.1
Median Detects	96	CV Detects	0.834
Skewness Detects	1.412	Kurtosis Detects	1.069
Mean of Logged Detects	4.524	SD of Logged Detects	0.775

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.341	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	60.26	KM Standard Error of Mean	17.75
KM SD	75.79	95% KM (BCA) UCL	90.2
95% KM (t) UCL	90.87	95% KM (Percentile Bootstrap) UCL	90.12
95% KM (z) UCL	89.45	95% KM Bootstrap t UCL	122.2
90% KM Chebyshev UCL	113.5	95% KM Chebyshev UCL	137.6
97.5% KM Chebyshev UCL	171.1	99% KM Chebyshev UCL	236.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.488	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.268	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.298	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.98	k star (bias corrected MLE)	1.321
Theta hat (MLE)	61.21	Theta star (bias corrected MLE)	91.76
nu hat (MLE)	31.68	nu star (bias corrected)	21.13
Mean (detects)	121.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	46.17
Maximum	320	Median	0.01
SD	84.93	CV	1.839
k hat (MLE)	0.154	k star (bias corrected MLE)	0.164
Theta hat (MLE)	299.2	Theta star (bias corrected MLE)	281.5
nu hat (MLE)	6.482	nu star (bias corrected)	6.889
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (6.89, α)	2.11	Adjusted Chi Square Value (6.89, β)	1.913
95% Gamma Approximate UCL (use when n>=50)	150.8	95% Gamma Adjusted UCL (use when n<50)	166.3

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	60.26	SD (KM)	75.79
Variance (KM)	5744	SE of Mean (KM)	17.75
k hat (KM)	0.632	k star (KM)	0.574
nu hat (KM)	26.55	nu star (KM)	24.09
theta hat (KM)	95.33	theta star (KM)	105.1
80% gamma percentile (KM)	99.31	90% gamma percentile (KM)	158.3
95% gamma percentile (KM)	220.4	99% gamma percentile (KM)	371.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.09, α)	13.92	Adjusted Chi Square Value (24.09, β)	13.32
95% Gamma Approximate KM-UCL (use when n>=50)	104.3	95% Gamma Adjusted KM-UCL (use when n<50)	109

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	53.86	Mean in Log Scale	3.223
SD in Original Scale	80.76	SD in Log Scale	1.203
95% t UCL (assumes normality of ROS data)	84.25	95% Percentile Bootstrap UCL	86.82
95% BCA Bootstrap UCL	93.73	95% Bootstrap t UCL	122.5
95% H-UCL (Log ROS)	111.5		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.637	KM Geo Mean	37.96
KM SD (logged)	0.844	95% Critical H Value (KM-Log)	2.361
KM Standard Error of Mean (logged)	0.2	95% H-UCL (KM -Log)	84.67
KM SD (logged)	0.844	95% Critical H Value (KM-Log)	2.361
KM Standard Error of Mean (logged)	0.2		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	56.12	Mean in Log Scale	3.367
SD in Original Scale	79.89	SD in Log Scale	1.095
95% t UCL (Assumes normality)	86.19	95% H-Stat UCL	102.1

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	109	95% GROS Adjusted Gamma UCL	166.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	21	Number of Distinct Observations	19
		Number of Missing Observations	3
Number of Detects	8	Number of Non-Detects	13
Number of Distinct Detects	8	Number of Distinct Non-Detects	11
Minimum Detect	22	Minimum Non-Detect	0.72
Maximum Detect	200	Maximum Non-Detect	3.4
Variance Detects	3161	Percent Non-Detects	61.9%
Mean Detects	89.63	SD Detects	56.22
Median Detects	77.5	CV Detects	0.627
Skewness Detects	1	Kurtosis Detects	1.194
Mean of Logged Detects	4.307	SD of Logged Detects	0.692

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	34.59	KM Standard Error of Mean	12.6
KM SD	54.02	95% KM (BCA) UCL	55.01
95% KM (t) UCL	56.32	95% KM (Percentile Bootstrap) UCL	55.17
95% KM (z) UCL	55.32	95% KM Bootstrap t UCL	61.69
90% KM Chebyshev UCL	72.39	95% KM Chebyshev UCL	89.52
97.5% KM Chebyshev UCL	113.3	99% KM Chebyshev UCL	160

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.159	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.722	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.124	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.8	k star (bias corrected MLE)	1.834
Theta hat (MLE)	32	Theta star (bias corrected MLE)	48.88
nu hat (MLE)	44.81	nu star (bias corrected)	29.34
Mean (detects)	89.63		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	34.15
Maximum	200	Median	0.01
SD	55.63	CV	1.629
k hat (MLE)	0.161	k star (bias corrected MLE)	0.169
Theta hat (MLE)	212.8	Theta star (bias corrected MLE)	201.7
nu hat (MLE)	6.742	nu star (bias corrected)	7.112
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (7.11, α)	2.232	Adjusted Chi Square Value (7.11, β)	2.028
95% Gamma Approximate UCL (use when n>=50)	108.8	95% Gamma Adjusted UCL (use when n<50)	119.8

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	34.59	SD (KM)	54.02
Variance (KM)	2918	SE of Mean (KM)	12.6
k hat (KM)	0.41	k star (KM)	0.383
nu hat (KM)	17.22	nu star (KM)	16.09
theta hat (KM)	84.36	theta star (KM)	90.26
80% gamma percentile (KM)	55.53	90% gamma percentile (KM)	98.43
95% gamma percentile (KM)	145.9	99% gamma percentile (KM)	265.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.09, α)	8.029	Adjusted Chi Square Value (16.09, β)	7.593
95% Gamma Approximate KM-UCL (use when n>=50)	69.34	95% Gamma Adjusted KM-UCL (use when n<50)	73.32

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	39.7	Mean in Log Scale	2.981
SD in Original Scale	52.16	SD in Log Scale	1.159
95% t UCL (assumes normality of ROS data)	59.33	95% Percentile Bootstrap UCL	58.95
95% BCA Bootstrap UCL	64.87	95% Bootstrap t UCL	69.23
95% H-UCL (Log ROS)	79.35		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.437	KM Geo Mean	4.209
KM SD (logged)	2.286	95% Critical H Value (KM-Log)	4.635
KM Standard Error of Mean (logged)	0.533	95% H-UCL (KM -Log)	613.8
KM SD (logged)	2.286	95% Critical H Value (KM-Log)	4.635
KM Standard Error of Mean (logged)	0.533		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	34.51	Mean in Log Scale	1.236
SD in Original Scale	55.4	SD in Log Scale	2.527
95% t UCL (Assumes normality)	55.36	95% H-Stat UCL	1465

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	56.32

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	21	Number of Distinct Observations	18
		Number of Missing Observations	3
Minimum	1600	Mean	6302
Maximum	12000	Median	5200
SD	2951	Std. Error of Mean	643.9
Coefficient of Variation	0.468	Skewness	0.356

Normal GOF Test

Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7413	95% Adjusted-CLT UCL (Chen-1995)	7415
		95% Modified-t UCL (Johnson-1978)	7421

Gamma GOF Test

A-D Test Statistic	0.459	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.131	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.19	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.269	k star (bias corrected MLE)	3.691
Theta hat (MLE)	1476	Theta star (bias corrected MLE)	1708
nu hat (MLE)	179.3	nu star (bias corrected)	155
MLE Mean (bias corrected)	6302	MLE Sd (bias corrected)	3281
		Approximate Chi Square Value (0.05)	127.2
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	125.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7679	95% Adjusted Gamma UCL (use when n<50)	7797

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.13	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.378	Mean of logged Data	8.627
Maximum of Logged Data	9.393	SD of logged Data	0.536

Assuming Lognormal Distribution

95% H-UCL	8212	90% Chebyshev (MVUE) UCL	8735
95% Chebyshev (MVUE) UCL	9795	97.5% Chebyshev (MVUE) UCL	11267
99% Chebyshev (MVUE) UCL	14158		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7362	95% Jackknife UCL	7413
95% Standard Bootstrap UCL	7322	95% Bootstrap-t UCL	7531
95% Hall's Bootstrap UCL	7478	95% Percentile Bootstrap UCL	7300
95% BCA Bootstrap UCL	7376		
90% Chebyshev(Mean, Sd) UCL	8234	95% Chebyshev(Mean, Sd) UCL	9109
97.5% Chebyshev(Mean, Sd) UCL	10324	99% Chebyshev(Mean, Sd) UCL	12709

Suggested UCL to Use

95% Student's-t UCL	7413

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	21	Number of Distinct Observations	18
		Number of Missing Observations	3
Number of Detects	18	Number of Non-Detects	3
Number of Distinct Detects	16	Number of Distinct Non-Detects	2
Minimum Detect	0.16	Minimum Non-Detect	0.14
Maximum Detect	5.4	Maximum Non-Detect	0.25
Variance Detects	1.44	Percent Non-Detects	14.29%
Mean Detects	0.706	SD Detects	1.2
Median Detects	0.37	CV Detects	1.701
Skewness Detects	3.93	Kurtosis Detects	16.05
Mean of Logged Detects	-0.85	SD of Logged Detects	0.834

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.428	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.374	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.627	KM Standard Error of Mean	0.246
KM SD	1.097	95% KM (BCA) UCL	1.097
95% KM (t) UCL	1.052	95% KM (Percentile Bootstrap) UCL	1.091
95% KM (z) UCL	1.032	95% KM Bootstrap t UCL	2.581
90% KM Chebyshev UCL	1.366	95% KM Chebyshev UCL	1.701
97.5% KM Chebyshev UCL	2.165	99% KM Chebyshev UCL	3.077

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.751	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.764	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.209	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.134	k star (bias corrected MLE)	0.982
Theta hat (MLE)	0.622	Theta star (bias corrected MLE)	0.718
nu hat (MLE)	40.84	nu star (bias corrected)	35.37
Mean (detects)	0.706		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.606
Maximum	5.4	Median	0.32
SD	1.134	CV	1.871
k hat (MLE)	0.684	k star (bias corrected MLE)	0.618
Theta hat (MLE)	0.886	Theta star (bias corrected MLE)	0.981
nu hat (MLE)	28.73	nu star (bias corrected)	25.96
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (25.96, α)	15.35	Adjusted Chi Square Value (25.96, β)	14.72
95% Gamma Approximate UCL (use when n>=50)	1.025	95% Gamma Adjusted UCL (use when n<50)	1.069

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.627	SD (KM)	1.097
Variance (KM)	1.202	SE of Mean (KM)	0.246
k hat (KM)	0.327	k star (KM)	0.312
nu hat (KM)	13.74	nu star (KM)	13.11
theta hat (KM)	1.917	theta star (KM)	2.009
80% gamma percentile (KM)	0.971	90% gamma percentile (KM)	1.841
95% gamma percentile (KM)	2.833	99% gamma percentile (KM)	5.398

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.11, α)	5.967	Adjusted Chi Square Value (13.11, β)	5.6
95% Gamma Approximate KM-UCL (use when n>=50)	1.378	95% Gamma Adjusted KM-UCL (use when n<50)	1.468

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.858	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.139	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.619	Mean in Log Scale	-1.074
SD in Original Scale	1.128	SD in Log Scale	0.965
95% t UCL (assumes normality of ROS data)	1.043	95% Percentile Bootstrap UCL	1.081
95% BCA Bootstrap UCL	1.326	95% Bootstrap t UCL	2.434
95% H-UCL (Log ROS)	0.937		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.996	KM Geo Mean	0.369
KM SD (logged)	0.833	95% Critical H Value (KM-Log)	2.348
KM Standard Error of Mean (logged)	0.187	95% H-UCL (KM -Log)	0.81
KM SD (logged)	0.833	95% Critical H Value (KM-Log)	2.348
KM Standard Error of Mean (logged)	0.187		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.617	Mean in Log Scale	-1.081
SD in Original Scale	1.128	SD in Log Scale	0.968
95% t UCL (Assumes normality)	1.042	95% H-Stat UCL	0.936

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.81

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
		Number of Missing Observations	3
Minimum	4.2	Mean	12.9
Maximum	59	Median	7.7
SD	13.16	Std. Error of Mean	2.872
Coefficient of Variation	1.02	Skewness	2.566

Normal GOF Test

Shapiro Wilk Test Statistic	0.646	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	17.85	95% Adjusted-CLT UCL (Chen-1995)	19.34
		95% Modified-t UCL (Johnson-1978)	18.12

Gamma GOF Test

A-D Test Statistic	1.679	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.253	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.192	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.806	k star (bias corrected MLE)	1.579
Theta hat (MLE)	7.143	Theta star (bias corrected MLE)	8.166
nu hat (MLE)	75.84	nu star (bias corrected)	66.34
MLE Mean (bias corrected)	12.9	MLE Sd (bias corrected)	10.26
		Approximate Chi Square Value (0.05)	48.59
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	47.43

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	17.61	95% Adjusted Gamma UCL (use when n<50)	18.04

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.863	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.199	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.435	Mean of logged Data	2.255
Maximum of Logged Data	4.078	SD of logged Data	0.713

Assuming Lognormal Distribution

95% H-UCL	17.48	90% Chebyshev (MVUE) UCL	18.18
95% Chebyshev (MVUE) UCL	20.92	97.5% Chebyshev (MVUE) UCL	24.73
99% Chebyshev (MVUE) UCL	32.21		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	17.62	95% Jackknife UCL	17.85
95% Standard Bootstrap UCL	17.4	95% Bootstrap-t UCL	22.41
95% Hall's Bootstrap UCL	23.23	95% Percentile Bootstrap UCL	18.1
95% BCA Bootstrap UCL	20.03		
90% Chebyshev(Mean, Sd) UCL	21.51	95% Chebyshev(Mean, Sd) UCL	25.42
97.5% Chebyshev(Mean, Sd) UCL	30.83	99% Chebyshev(Mean, Sd) UCL	41.47

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	25.42

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	21	Number of Distinct Observations	14
		Number of Missing Observations	3
Number of Detects	9	Number of Non-Detects	12
Number of Distinct Detects	9	Number of Distinct Non-Detects	6
Minimum Detect	0.29	Minimum Non-Detect	0.27
Maximum Detect	7.5	Maximum Non-Detect	0.57
Variance Detects	5.137	Percent Non-Detects	57.14%
Mean Detects	1.536	SD Detects	2.266
Median Detects	0.9	CV Detects	1.476
Skewness Detects	2.852	Kurtosis Detects	8.337
Mean of Logged Detects	-0.0933	SD of Logged Detects	0.942

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.537	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.814	KM Standard Error of Mean	0.355
KM SD	1.532	95% KM (BCA) UCL	1.474
95% KM (t) UCL	1.425	95% KM (Percentile Bootstrap) UCL	1.455
95% KM (z) UCL	1.397	95% KM Bootstrap t UCL	3.236
90% KM Chebyshev UCL	1.878	95% KM Chebyshev UCL	2.36
97.5% KM Chebyshev UCL	3.029	99% KM Chebyshev UCL	4.343

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.041	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.742	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.327	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.286	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.094	k star (bias corrected MLE)	0.803
Theta hat (MLE)	1.403	Theta star (bias corrected MLE)	1.911
nu hat (MLE)	19.69	nu star (bias corrected)	14.46
Mean (detects)	1.536		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.664
Maximum	7.5	Median	0.01
SD	1.629	CV	2.454
k hat (MLE)	0.304	k star (bias corrected MLE)	0.292
Theta hat (MLE)	2.182	Theta star (bias corrected MLE)	2.27
nu hat (MLE)	12.78	nu star (bias corrected)	12.28
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (12.28, α)	5.415	Adjusted Chi Square Value (12.28, β)	5.067
95% Gamma Approximate UCL (use when n>=50)	1.506	95% Gamma Adjusted UCL (use when n<50)	1.609

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.814	SD (KM)	1.532
Variance (KM)	2.348	SE of Mean (KM)	0.355
k hat (KM)	0.282	k star (KM)	0.273
nu hat (KM)	11.84	nu star (KM)	11.48
theta hat (KM)	2.886	theta star (KM)	2.976
80% gamma percentile (KM)	1.217	90% gamma percentile (KM)	2.424
95% gamma percentile (KM)	3.833	99% gamma percentile (KM)	7.537

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.48, α)	4.89	Adjusted Chi Square Value (11.48, β)	4.562
95% Gamma Approximate KM-UCL (use when n>=50)	1.911	95% Gamma Adjusted KM-UCL (use when n<50)	2.048

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.864	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.704	Mean in Log Scale	-1.572
SD in Original Scale	1.613	SD in Log Scale	1.511
95% t UCL (assumes normality of ROS data)	1.311	95% Percentile Bootstrap UCL	1.354
95% BCA Bootstrap UCL	1.723	95% Bootstrap t UCL	2.795
95% H-UCL (Log ROS)	2.003		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.784	KM Geo Mean	0.456
KM SD (logged)	0.835	95% Critical H Value (KM-Log)	2.35
KM Standard Error of Mean (logged)	0.194	95% H-UCL (KM -Log)	1.004
KM SD (logged)	0.835	95% Critical H Value (KM-Log)	2.35
KM Standard Error of Mean (logged)	0.194		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.747	Mean in Log Scale	-1.117
SD in Original Scale	1.595	SD in Log Scale	1.098
95% t UCL (Assumes normality)	1.347	95% H-Stat UCL	1.16

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1.004

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
		Number of Missing Observations	3
Minimum	2.4	Mean	5.752
Maximum	12	Median	4.8
SD	2.447	Std. Error of Mean	0.534
Coefficient of Variation	0.425	Skewness	0.938

Normal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.673	95% Adjusted-CLT UCL (Chen-1995)	6.748
		95% Modified-t UCL (Johnson-1978)	6.692

Gamma GOF Test

A-D Test Statistic	0.433	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.144	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.19	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.289	k star (bias corrected MLE)	5.422
Theta hat (MLE)	0.915	Theta star (bias corrected MLE)	1.061
nu hat (MLE)	264.1	nu star (bias corrected)	227.7
MLE Mean (bias corrected)	5.752	MLE Sd (bias corrected)	2.47
		Approximate Chi Square Value (0.05)	193.8
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	191.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.76	95% Adjusted Gamma UCL (use when n<50)	6.844

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.121	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.875	Mean of logged Data	1.668
Maximum of Logged Data	2.485	SD of logged Data	0.412

Assuming Lognormal Distribution

95% H-UCL	6.885	90% Chebyshev (MVUE) UCL	7.337
95% Chebyshev (MVUE) UCL	8.058	97.5% Chebyshev (MVUE) UCL	9.058
99% Chebyshev (MVUE) UCL	11.02		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.631	95% Jackknife UCL	6.673
95% Standard Bootstrap UCL	6.612	95% Bootstrap-t UCL	6.872
95% Hall's Bootstrap UCL	6.82	95% Percentile Bootstrap UCL	6.624
95% BCA Bootstrap UCL	6.717		
90% Chebyshev(Mean, Sd) UCL	7.354	95% Chebyshev(Mean, Sd) UCL	8.08
97.5% Chebyshev(Mean, Sd) UCL	9.087	99% Chebyshev(Mean, Sd) UCL	11.07

Suggested UCL to Use

95% Student's-t UCL	6.673

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	21	Number of Distinct Observations	17
		Number of Missing Observations	3
Minimum	9.9	Mean	82.73
Maximum	960	Median	23
SD	207.5	Std. Error of Mean	45.29
Coefficient of Variation	2.508	Skewness	4.173

Normal GOF Test

Shapiro Wilk Test Statistic	0.362	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.437	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	160.8	95% Adjusted-CLT UCL (Chen-1995)	201.3
		95% Modified-t UCL (Johnson-1978)	167.7

Gamma GOF Test

A-D Test Statistic	3.275	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.794	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.379	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.199	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.623	k star (bias corrected MLE)	0.566
Theta hat (MLE)	132.8	Theta star (bias corrected MLE)	146.2
nu hat (MLE)	26.17	nu star (bias corrected)	23.76
MLE Mean (bias corrected)	82.73	MLE Sd (bias corrected)	110
		Approximate Chi Square Value (0.05)	13.67
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	13.08

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	143.8	95% Adjusted Gamma UCL (use when n<50)	150.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.778	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.255	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.293	Mean of logged Data	3.429
Maximum of Logged Data	6.867	SD of logged Data	1.092

Assuming Lognormal Distribution

95% H-UCL	108.1	90% Chebyshev (MVUE) UCL	97.47
95% Chebyshev (MVUE) UCL	117.3	97.5% Chebyshev (MVUE) UCL	144.8
99% Chebyshev (MVUE) UCL	198.9		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	157.2	95% Jackknife UCL	160.8
95% Standard Bootstrap UCL	155.2	95% Bootstrap-t UCL	574.5
95% Hall's Bootstrap UCL	502.7	95% Percentile Bootstrap UCL	167
95% BCA Bootstrap UCL	216.4		
90% Chebyshev(Mean, Sd) UCL	218.6	95% Chebyshev(Mean, Sd) UCL	280.1
97.5% Chebyshev(Mean, Sd) UCL	365.6	99% Chebyshev(Mean, Sd) UCL	533.3

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	280.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	21	Number of Distinct Observations	16
		Number of Missing Observations	3
Minimum	4300	Mean	12633
Maximum	23000	Median	12000
SD	5231	Std. Error of Mean	1142
Coefficient of Variation	0.414	Skewness	0.31

Normal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	14602	95% Adjusted-CLT UCL (Chen-1995)	14594
		95% Modified-t UCL (Johnson-1978)	14615

Gamma GOF Test

A-D Test Statistic	0.458	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.147	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.19	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.434	k star (bias corrected MLE)	4.69
Theta hat (MLE)	2325	Theta star (bias corrected MLE)	2694
nu hat (MLE)	228.2	nu star (bias corrected)	197
MLE Mean (bias corrected)	12633	MLE Sd (bias corrected)	5834
		Approximate Chi Square Value (0.05)	165.5
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	163.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	15036	95% Adjusted Gamma UCL (use when n<50)	15240

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.366	Mean of logged Data	9.349
Maximum of Logged Data	10.04	SD of logged Data	0.471

Assuming Lognormal Distribution

95% H-UCL	15794	90% Chebyshev (MVUE) UCL	16840
95% Chebyshev (MVUE) UCL	18684	97.5% Chebyshev (MVUE) UCL	21245
99% Chebyshev (MVUE) UCL	26275		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	14511	95% Jackknife UCL	14602
95% Standard Bootstrap UCL	14494	95% Bootstrap-t UCL	14700
95% Hall's Bootstrap UCL	14558	95% Percentile Bootstrap UCL	14514
95% BCA Bootstrap UCL	14529		
90% Chebyshev(Mean, Sd) UCL	16058	95% Chebyshev(Mean, Sd) UCL	17609
97.5% Chebyshev(Mean, Sd) UCL	19762	99% Chebyshev(Mean, Sd) UCL	23992

Suggested UCL to Use

95% Student's-t UCL	14602

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	21	Number of Distinct Observations	21
		Number of Missing Observations	3
Minimum	31	Mean	379.4
Maximum	1000	Median	330
SD	268.6	Std. Error of Mean	58.62
Coefficient of Variation	0.708	Skewness	0.943

Normal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.122	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	480.5	95% Adjusted-CLT UCL (Chen-1995)	488.7
		95% Modified-t UCL (Johnson-1978)	482.5

Gamma GOF Test

A-D Test Statistic	0.165	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0872	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.192	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.768	k star (bias corrected MLE)	1.547
Theta hat (MLE)	214.6	Theta star (bias corrected MLE)	245.2
nu hat (MLE)	74.25	nu star (bias corrected)	64.98
MLE Mean (bias corrected)	379.4	MLE Sd (bias corrected)	305
		Approximate Chi Square Value (0.05)	47.43
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	46.28

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	519.7	95% Adjusted Gamma UCL (use when n<50)	532.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.14	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.434	Mean of logged Data	5.63
Maximum of Logged Data	6.908	SD of logged Data	0.914

Assuming Lognormal Distribution

95% H-UCL	697.6	90% Chebyshev (MVUE) UCL	684.4
95% Chebyshev (MVUE) UCL	807.9	97.5% Chebyshev (MVUE) UCL	979.4
99% Chebyshev (MVUE) UCL	1316		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	475.8	95% Jackknife UCL	480.5
95% Standard Bootstrap UCL	474.4	95% Bootstrap-t UCL	503.3
95% Hall's Bootstrap UCL	500.3	95% Percentile Bootstrap UCL	477.6
95% BCA Bootstrap UCL	479.5		
90% Chebyshev(Mean, Sd) UCL	555.2	95% Chebyshev(Mean, Sd) UCL	634.9
97.5% Chebyshev(Mean, Sd) UCL	745.5	99% Chebyshev(Mean, Sd) UCL	962.7

Suggested UCL to Use

95% Student's-t UCL	480.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	21	Number of Distinct Observations	16
		Number of Missing Observations	3
Minimum	8.2	Mean	69.75
Maximum	700	Median	14
SD	175.2	Std. Error of Mean	38.23
Coefficient of Variation	2.512	Skewness	3.199

Normal GOF Test

Shapiro Wilk Test Statistic	0.378	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.499	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	135.7	95% Adjusted-CLT UCL (Chen-1995)	161.2
		95% Modified-t UCL (Johnson-1978)	140.1

Gamma GOF Test

A-D Test Statistic	4.73	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.804	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.438	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.2	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.517	k star (bias corrected MLE)	0.475
Theta hat (MLE)	135	Theta star (bias corrected MLE)	147
nu hat (MLE)	21.7	nu star (bias corrected)	19.93
MLE Mean (bias corrected)	69.75	MLE Sd (bias corrected)	101.3
		Approximate Chi Square Value (0.05)	10.8
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	10.28

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	128.7	95% Adjusted Gamma UCL (use when n<50)	135.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.64	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.3	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.104	Mean of logged Data	3.022
Maximum of Logged Data	6.551	SD of logged Data	1.167

Assuming Lognormal Distribution

95% H-UCL	84.2	90% Chebyshev (MVUE) UCL	72.53
95% Chebyshev (MVUE) UCL	87.91	97.5% Chebyshev (MVUE) UCL	109.3
99% Chebyshev (MVUE) UCL	151.2		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	132.6	95% Jackknife UCL	135.7
95% Standard Bootstrap UCL	130.8	95% Bootstrap-t UCL	1701
95% Hall's Bootstrap UCL	674.1	95% Percentile Bootstrap UCL	143.8
95% BCA Bootstrap UCL	177.2		
90% Chebyshev(Mean, Sd) UCL	184.5	95% Chebyshev(Mean, Sd) UCL	236.4
97.5% Chebyshev(Mean, Sd) UCL	308.5	99% Chebyshev(Mean, Sd) UCL	450.2

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	236.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	21	Number of Distinct Observations	20
		Number of Missing Observations	3
Number of Detects	20	Number of Non-Detects	1
Number of Distinct Detects	19	Number of Distinct Non-Detects	1
Minimum Detect	0.063	Minimum Non-Detect	0.095
Maximum Detect	2.7	Maximum Non-Detect	0.095
Variance Detects	0.365	Percent Non-Detects	4.762%
Mean Detects	0.377	SD Detects	0.604
Median Detects	0.163	CV Detects	1.603
Skewness Detects	3.38	Kurtosis Detects	12.46
Mean of Logged Detects	-1.557	SD of Logged Detects	0.944

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.519	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.333	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.362	KM Standard Error of Mean	0.129
KM SD	0.578	95% KM (BCA) UCL	0.586
95% KM (t) UCL	0.586	95% KM (Percentile Bootstrap) UCL	0.594
95% KM (z) UCL	0.575	95% KM Bootstrap t UCL	0.991
90% KM Chebyshev UCL	0.751	95% KM Chebyshev UCL	0.927
97.5% KM Chebyshev UCL	1.171	99% KM Chebyshev UCL	1.65

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.932	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.768	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.287	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.199	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.994	k star (bias corrected MLE)	0.879
Theta hat (MLE)	0.379	Theta star (bias corrected MLE)	0.429
nu hat (MLE)	39.78	nu star (bias corrected)	35.14
Mean (detects)	0.377		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.359
Maximum	2.7	Median	0.16
SD	0.594	CV	1.653
k hat (MLE)	0.866	k star (bias corrected MLE)	0.774
Theta hat (MLE)	0.415	Theta star (bias corrected MLE)	0.464
nu hat (MLE)	36.36	nu star (bias corrected)	32.5
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (32.50, α)	20.47	Adjusted Chi Square Value (32.50, β)	19.74
95% Gamma Approximate UCL (use when n>=50)	0.571	95% Gamma Adjusted UCL (use when n<50)	0.592

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.362	SD (KM)	0.578
Variance (KM)	0.334	SE of Mean (KM)	0.129
k hat (KM)	0.393	k star (KM)	0.368
nu hat (KM)	16.5	nu star (KM)	15.47
theta hat (KM)	0.923	theta star (KM)	0.984
80% gamma percentile (KM)	0.578	90% gamma percentile (KM)	1.038
95% gamma percentile (KM)	1.549	99% gamma percentile (KM)	2.844

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.47, α)	7.592	Adjusted Chi Square Value (15.47, β)	7.17
95% Gamma Approximate KM-UCL (use when n>=50)	0.739	95% Gamma Adjusted KM-UCL (use when n<50)	0.782

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.872	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.192	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.361	Mean in Log Scale	-1.629
SD in Original Scale	0.593	SD in Log Scale	0.979
95% t UCL (assumes normality of ROS data)	0.584	95% Percentile Bootstrap UCL	0.587
95% BCA Bootstrap UCL	0.707	95% Bootstrap t UCL	1.047
95% H-UCL (Log ROS)	0.551		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.608	KM Geo Mean	0.2
KM SD (logged)	0.928	95% Critical H Value (KM-Log)	2.468
KM Standard Error of Mean (logged)	0.208	95% H-UCL (KM -Log)	0.514
KM SD (logged)	0.928	95% Critical H Value (KM-Log)	2.468
KM Standard Error of Mean (logged)	0.208		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.361	Mean in Log Scale	-1.628
SD in Original Scale	0.593	SD in Log Scale	0.976
95% t UCL (Assumes normality)	0.584	95% H-Stat UCL	0.549

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	0.927

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	21	Number of Distinct Observations	18
		Number of Missing Observations	3
Minimum	10	Mean	23.95
Maximum	45	Median	23
SD	10.35	Std. Error of Mean	2.259
Coefficient of Variation	0.432	Skewness	0.694

Normal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.11	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	27.85	95% Adjusted-CLT UCL (Chen-1995)	28.03
		95% Modified-t UCL (Johnson-1978)	27.91

Gamma GOF Test

A-D Test Statistic	0.27	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0962	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.19	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.639	k star (bias corrected MLE)	4.865
Theta hat (MLE)	4.247	Theta star (bias corrected MLE)	4.923
nu hat (MLE)	236.8	nu star (bias corrected)	204.3
MLE Mean (bias corrected)	23.95	MLE Sd (bias corrected)	10.86
		Approximate Chi Square Value (0.05)	172.3
Adjusted Level of Significance	0.0383	Adjusted Chi Square Value	170

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	28.41	95% Adjusted Gamma UCL (use when n<50)	28.79

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.908	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.125	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.188	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.303	Mean of logged Data	3.085
Maximum of Logged Data	3.807	SD of logged Data	0.446

Assuming Lognormal Distribution

95% H-UCL	29.32	90% Chebyshev (MVUE) UCL	31.26
95% Chebyshev (MVUE) UCL	34.54	97.5% Chebyshev (MVUE) UCL	39.09
99% Chebyshev (MVUE) UCL	48.02		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	27.67	95% Jackknife UCL	27.85
95% Standard Bootstrap UCL	27.6	95% Bootstrap-t UCL	28.39
95% Hall's Bootstrap UCL	28.34	95% Percentile Bootstrap UCL	27.67
95% BCA Bootstrap UCL	28.24		
90% Chebyshev(Mean, Sd) UCL	30.73	95% Chebyshev(Mean, Sd) UCL	33.8
97.5% Chebyshev(Mean, Sd) UCL	38.06	99% Chebyshev(Mean, Sd) UCL	46.43

Suggested UCL to Use

95% Student's-t UCL	27.85

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	21	Number of Distinct Observations	13
		Number of Missing Observations	3
Number of Detects	2	Number of Non-Detects	19
Number of Distinct Detects	2	Number of Distinct Non-Detects	11
Minimum Detect	74	Minimum Non-Detect	25
Maximum Detect	400	Maximum Non-Detect	52
Variance Detects	53138	Percent Non-Detects	90.48%
Mean Detects	237	SD Detects	230.5
Median Detects	237	CV Detects	0.973
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	5.148	SD of Logged Detects	1.193

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	45.19	KM Standard Error of Mean	24.69
KM SD	80.02	95% KM (BCA) UCL	N/A
95% KM (t) UCL	87.78	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	85.81	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	119.3	95% KM Chebyshev UCL	152.8
97.5% KM Chebyshev UCL	199.4	99% KM Chebyshev UCL	290.9

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.709	k star (bias corrected MLE)	N/A
Theta hat (MLE)	138.7	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	6.835	nu star (bias corrected)	N/A
Mean (detects)	237		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	45.19	SD (KM)	80.02
Variance (KM)	6403	SE of Mean (KM)	24.69
k hat (KM)	0.319	k star (KM)	0.305
nu hat (KM)	13.4	nu star (KM)	12.82
theta hat (KM)	141.7	theta star (KM)	148.1
80% gamma percentile (KM)	69.59	90% gamma percentile (KM)	133
95% gamma percentile (KM)	205.6	99% gamma percentile (KM)	393.9

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0383
Approximate Chi Square Value (12.82, α)	5.769	Adjusted Chi Square Value (12.82, β)	5.408
95% Gamma Approximate KM-UCL (use when n>=50)	100.4	95% Gamma Adjusted KM-UCL (use when n<50)	107.1

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	22.66	Mean in Log Scale	-3.29
SD in Original Scale	87.95	SD in Log Scale	3.472
95% t UCL (assumes normality of ROS data)	55.76	95% Percentile Bootstrap UCL	60.7
95% BCA Bootstrap UCL	83.34	95% Bootstrap t UCL	9150
95% H-UCL (Log ROS)	2940		

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248) (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.403	KM Geo Mean	30.04
KM SD (logged)	0.623	95% Critical H Value (KM-Log)	2.109
KM Standard Error of Mean (logged)	0.192	95% H-UCL (KM -Log)	48.94
KM SD (logged)	0.623	95% Critical H Value (KM-Log)	2.109
KM Standard Error of Mean (logged)	0.192		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	36.27	Mean in Log Scale	2.935
SD in Original Scale	84.37	SD in Log Scale	0.8
95% t UCL (Assumes normality)	68.03	95% H-Stat UCL	39.13

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	152.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	21	Number of Distinct Observations	13
		Number of Missing Observations	3
Number of Detects	4	Number of Non-Detects	17
Number of Distinct Detects	4	Number of Distinct Non-Detects	9
Minimum Detect	54	Minimum Non-Detect	25
Maximum Detect	160	Maximum Non-Detect	50
Variance Detects	2086	Percent Non-Detects	80.95%
Mean Detects	94.75	SD Detects	45.68
Median Detects	82.5	CV Detects	0.482
Skewness Detects	1.434	Kurtosis Detects	2.557
Mean of Logged Detects	4.472	SD of Logged Detects	0.451

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.317	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	38.29	KM Standard Error of Mean	8.158
KM SD	32.38	95% KM (BCA) UCL	N/A
95% KM (t) UCL	52.36	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	51.7	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	62.76	95% KM Chebyshev UCL	73.85
97.5% KM Chebyshev UCL	89.23	99% KM Chebyshev UCL	119.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.32	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.658	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.282	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.448	k star (bias corrected MLE)	1.779
Theta hat (MLE)	14.7	Theta star (bias corrected MLE)	53.27
nu hat (MLE)	51.58	nu star (bias corrected)	14.23
Mean (detects)	94.75		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	18.06
Maximum	160	Median	0.01
SD	42.03	CV	2.328
k hat (MLE)	0.135	k star (bias corrected MLE)	0.148
Theta hat (MLE)	133.5	Theta star (bias corrected MLE)	122.3
nu hat (MLE)	5.679	nu star (bias corrected)	6.201
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (6.20, α)	1.743	Adjusted Chi Square Value (6.20, β)	1.569
95% Gamma Approximate UCL (use when n>=50)	64.22	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.6.4

Summary of ProUCL Output for EU05-EU08 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 1:31:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	38.29	SD (KM)	32.38
Variance (KM)	1048	SE of Mean (KM)	8.158
k hat (KM)	1.398	k star (KM)	1.23
nu hat (KM)	58.73	nu star (KM)	51.68
theta hat (KM)	27.38	theta star (KM)	31.12
80% gamma percentile (KM)	60.47	90% gamma percentile (KM)	83.76
95% gamma percentile (KM)	106.7	99% gamma percentile (KM)	159.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (51.68, α)	36.17	Adjusted Chi Square Value (51.68, β)	35.17
95% Gamma Approximate KM-UCL (use when n>=50)	54.71	95% Gamma Adjusted KM-UCL (use when n<50)	56.26

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.255	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	26.93	Mean in Log Scale	2.666
SD in Original Scale	38.49	SD in Log Scale	1.057
95% t UCL (assumes normality of ROS data)	41.42	95% Percentile Bootstrap UCL	41.72
95% BCA Bootstrap UCL	45.12	95% Bootstrap t UCL	57.23
95% H-UCL (Log ROS)	46.93		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.458	KM Geo Mean	31.74
KM SD (logged)	0.521	95% Critical H Value (KM-Log)	2.008
KM Standard Error of Mean (logged)	0.131	95% H-UCL (KM -Log)	45.92
KM SD (logged)	0.521	95% Critical H Value (KM-Log)	2.008
KM Standard Error of Mean (logged)	0.131		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	30.02	Mean in Log Scale	3.02
SD in Original Scale	36.82	SD in Log Scale	0.759
95% t UCL (Assumes normality)	43.88	95% H-Stat UCL	40.08

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	52.36

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.1

Summary of ProUCL Input Data for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole
on-site (EU09)	SS-86	11/2/2017	0-2 ft BGS	0.47	0	27000	1	17000	1	25000	1	8400	1
on-site (EU09)	SS-87	10/31/2018	0.5-2.5 ft BGS	0.695	0	925	1	915	1	1300	1	185	1
on-site (EU09)	SS-88	10/31/2018	0.5-2.5 ft BGS										
on-site (EU09)	SS-90	10/31/2018	0.17-2.17 ft BGS	0.72	0	34	1	35	1	56	1	23	1
on-site (EU09)	SS-91	10/31/2018	0.5-2.5 ft BGS	0.62	0	720	1	690	1	970	1	140	1
on-site (EU09)	SS-92	10/31/2018	0-2 ft BGS	4.3	1	190	0	520	0	600	1	1100	0
on-site (EU09)	SS-93	10/31/2018	0-2 ft BGS	0.69	0	100	1	84	1	340	1	21	0
on-site (EU09)	SS-161-AS	10/31/2018	0.5-1 ft BGS										
on-site (EU09)	SS-162-AS	10/31/2018	0.17-0.67 ft BGS										

Table B.7.1

Summary of ProUCL Input Data for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				10	11	12	13	14	15	16	17	18	19
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt
on-site (EU09)	SS-86	11/2/2017	0-2 ft BGS	2700	1	7600	1	15	1	1.9	1	6.8	1
on-site (EU09)	SS-87	10/31/2018	0.5-2.5 ft BGS	140	1	485	1	6.45	1	0.275	0	4.35	1
on-site (EU09)	SS-88	10/31/2018	0.5-2.5 ft BGS										
on-site (EU09)	SS-90	10/31/2018	0.17-2.17 ft BGS	8.3	1	14	1	4.1	1	0.42	1	4.3	1
on-site (EU09)	SS-91	10/31/2018	0.5-2.5 ft BGS	120	1	370	1	6.4	1	0.26	0	3.5	1
on-site (EU09)	SS-92	10/31/2018	0-2 ft BGS	390	0	410	0	11	1	0.27	0	6	1
on-site (EU09)	SS-93	10/31/2018	0-2 ft BGS	48	1	120	1	12	1	0.26	0	4.7	1
on-site (EU09)	SS-161-AS	10/31/2018	0.5-1 ft BGS										
on-site (EU09)	SS-162-AS	10/31/2018	0.17-0.67 ft BGS										

Table B.7.1

Summary of ProUCL Input Data for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				20	21	22	23	24	25	26	27	28	29	30	31
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Copper	D_Copper	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU09)	SS-86	11/2/2017	0-2 ft BGS	37	1	13000	1	270	1	0.53	1	30	1	41	1
on-site (EU09)	SS-87	10/31/2018	0.5-2.5 ft BGS	20.5	1	11500	1	360	1	0.175	1	17.5	1	25.5	0
on-site (EU09)	SS-88	10/31/2018	0.5-2.5 ft BGS												
on-site (EU09)	SS-90	10/31/2018	0.17-2.17 ft BGS	3700	1	17000	1	300	1	0.1	1	60	1	24	0
on-site (EU09)	SS-91	10/31/2018	0.5-2.5 ft BGS	21	1	24000	1	560	1	0.13	1	16	1	170	1
on-site (EU09)	SS-92	10/31/2018	0-2 ft BGS	40	1	14000	1	470	1	0.27	1	21	1	260	0
on-site (EU09)	SS-93	10/31/2018	0-2 ft BGS	50	1	11000	1	230	1	0.32	1	17	1	25	0
on-site (EU09)	SS-161-AS	10/31/2018	0.5-1 ft BGS												
on-site (EU09)	SS-162-AS	10/31/2018	0.17-0.67 ft BGS												

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Number of Detects	1	Number of Non-Detects	5
Number of Distinct Detects	1	Number of Distinct Non-Detects	5

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,1-Dichloroethane was not processed!

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	34	Minimum Non-Detect	190
Maximum Detect	27000	Maximum Non-Detect	190
Variance Detects	1.412E+8	Percent Non-Detects	16.67%
Mean Detects	5756	SD Detects	11882
Median Detects	720	CV Detects	2.064
Skewness Detects	2.23	Kurtosis Detects	4.979
Mean of Logged Detects	6.349	SD of Logged Detects	2.557

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.581	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.458	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4808	KM Standard Error of Mean	4533
KM SD	9931	95% KM (BCA) UCL	13631
95% KM (t) UCL	13941	95% KM (Percentile Bootstrap) UCL	13642
95% KM (z) UCL	12263	95% KM Bootstrap t UCL	153788
90% KM Chebyshev UCL	18406	95% KM Chebyshev UCL	24565
97.5% KM Chebyshev UCL	33114	99% KM Chebyshev UCL	49908

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.534	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.355	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.38	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.299	k star (bias corrected MLE)	0.253
Theta hat (MLE)	19262	Theta star (bias corrected MLE)	22763
nu hat (MLE)	2.988	nu star (bias corrected)	2.529
Mean (detects)	5756		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4797
Maximum	27000	Median	410
SD	10884	CV	2.269
k hat (MLE)	0.188	k star (bias corrected MLE)	0.205
Theta hat (MLE)	25515	Theta star (bias corrected MLE)	23386
nu hat (MLE)	2.256	nu star (bias corrected)	2.461
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (2.46, α)	0.233	Adjusted Chi Square Value (2.46, β)	0.11
95% Gamma Approximate UCL (use when n>=50)	50773	95% Gamma Adjusted UCL (use when n<50)	107434

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4808	SD (KM)	9931
Variance (KM)	98618134	SE of Mean (KM)	4533
k hat (KM)	0.234	k star (KM)	0.228
nu hat (KM)	2.813	nu star (KM)	2.74
theta hat (KM)	20513	theta star (KM)	21059
80% gamma percentile (KM)	6742	90% gamma percentile (KM)	14505
95% gamma percentile (KM)	23895	99% gamma percentile (KM)	49218

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (2.74, α)	0.3	Adjusted Chi Square Value (2.74, β)	0.136
95% Gamma Approximate KM-UCL (use when n>=50)	43956	95% Gamma Adjusted KM-UCL (use when n<50)	97188

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4805	Mean in Log Scale	5.954
SD in Original Scale	10880	SD in Log Scale	2.483
95% t UCL (assumes normality of ROS data)	13755	95% Percentile Bootstrap UCL	13631
95% BCA Bootstrap UCL	13825	95% Bootstrap t UCL	153630
95% H-UCL (Log ROS)	3.147E+8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.968	KM Geo Mean	390.8
KM SD (logged)	2.265	95% Critical H Value (KM-Log)	8.677
KM Standard Error of Mean (logged)	1.041	95% H-UCL (KM -Log)	33376190
KM SD (logged)	2.265	95% Critical H Value (KM-Log)	8.677
KM Standard Error of Mean (logged)	1.041		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4812	Mean in Log Scale	6.05
SD in Original Scale	10876	SD in Log Scale	2.401
95% t UCL (Assumes normality)	13759	95% H-Stat UCL	1.451E+8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	153788	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	97188

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	35	Minimum Non-Detect	520
Maximum Detect	17000	Maximum Non-Detect	520
Variance Detects	55050993	Percent Non-Detects	16.67%
Mean Detects	3745	SD Detects	7420
Median Detects	690	CV Detects	1.981
Skewness Detects	2.221	Kurtosis Detects	4.947
Mean of Logged Detects	6.217	SD of Logged Detects	2.406

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.598	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.449	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3131	KM Standard Error of Mean	2835
KM SD	6212	95% KM (BCA) UCL	8542
95% KM (t) UCL	8844	95% KM (Percentile Bootstrap) UCL	8542
95% KM (z) UCL	7794	95% KM Bootstrap t UCL	77766
90% KM Chebyshev UCL	11637	95% KM Chebyshev UCL	15489
97.5% KM Chebyshev UCL	20837	99% KM Chebyshev UCL	31342

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.475	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.326	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.378	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.336	k star (bias corrected MLE)	0.268
Theta hat (MLE)	11131	Theta star (bias corrected MLE)	13978
nu hat (MLE)	3.364	nu star (bias corrected)	2.679
Mean (detects)	3745		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3121
Maximum	17000	Median	387
SD	6810	CV	2.182
k hat (MLE)	0.202	k star (bias corrected MLE)	0.212
Theta hat (MLE)	15432	Theta star (bias corrected MLE)	14705
nu hat (MLE)	2.427	nu star (bias corrected)	2.547
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (2.55, α)	0.252	Adjusted Chi Square Value (2.55, β)	0.117
95% Gamma Approximate UCL (use when n>=50)	31557	95% Gamma Adjusted UCL (use when n<50)	68024

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3131	SD (KM)	6212
Variance (KM)	38587072	SE of Mean (KM)	2835
k hat (KM)	0.254	k star (KM)	0.238
nu hat (KM)	3.048	nu star (KM)	2.857
theta hat (KM)	12326	theta star (KM)	13148
80% gamma percentile (KM)	4465	90% gamma percentile (KM)	9426
95% gamma percentile (KM)	15372	99% gamma percentile (KM)	31312

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (2.86, α)	0.331	Adjusted Chi Square Value (2.86, β)	0.149
95% Gamma Approximate KM-UCL (use when n>=50)	26990	95% Gamma Adjusted KM-UCL (use when n<50)	60057

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3129	Mean in Log Scale	5.841
SD in Original Scale	6805	SD in Log Scale	2.34
95% t UCL (assumes normality of ROS data)	8728	95% Percentile Bootstrap UCL	8635
95% BCA Bootstrap UCL	8814	95% Bootstrap t UCL	63807
95% H-UCL (Log ROS)	62620619		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.846	KM Geo Mean	345.8
KM SD (logged)	2.14	95% Critical H Value (KM-Log)	8.214
KM Standard Error of Mean (logged)	0.982	95% H-UCL (KM -Log)	8844641
KM SD (logged)	2.14	95% Critical H Value (KM-Log)	8.214
KM Standard Error of Mean (logged)	0.982		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3164	Mean in Log Scale	6.107
SD in Original Scale	6787	SD in Log Scale	2.169
95% t UCL (Assumes normality)	8747	95% H-Stat UCL	15087571

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	77766	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	60057

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Minimum	56	Mean	4711
Maximum	25000	Median	785
SD	9949	Std. Error of Mean	4062
Coefficient of Variation	2.112	Skewness	2.439

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.54	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.467	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	12896	95% Adjusted-CLT UCL (Chen-1995)	15713
		95% Modified-t UCL (Johnson-1978)	13570

Gamma GOF Test

A-D Test Statistic	0.698	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.372	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.353	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.385	k star (bias corrected MLE)	0.304
Theta hat (MLE)	12238	Theta star (bias corrected MLE)	15518
nu hat (MLE)	4.619	nu star (bias corrected)	3.643
MLE Mean (bias corrected)	4711	MLE Sd (bias corrected)	8550
		Approximate Chi Square Value (0.05)	0.586
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.275

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	29290	95% Adjusted Gamma UCL (use when n<50)	62334

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.248	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.025	Mean of logged Data	6.738
Maximum of Logged Data	10.13	SD of logged Data	2

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Assuming Lognormal Distribution

95% H-UCL	6084256	90% Chebyshev (MVUE) UCL	10691
95% Chebyshev (MVUE) UCL	13994	97.5% Chebyshev (MVUE) UCL	18579
99% Chebyshev (MVUE) UCL	27585		

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	11392	95% Jackknife UCL	12896
95% Standard Bootstrap UCL	10910	95% Bootstrap-t UCL	127395
95% Hall's Bootstrap UCL	85209	95% Percentile Bootstrap UCL	12757
95% BCA Bootstrap UCL	13040		
90% Chebyshev(Mean, Sd) UCL	16896	95% Chebyshev(Mean, Sd) UCL	22416
97.5% Chebyshev(Mean, Sd) UCL	30077	99% Chebyshev(Mean, Sd) UCL	45125

Suggested UCL to Use

95% Adjusted Gamma UCL	62334

Recommended UCL exceeds the maximum observation

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Number of Detects	4	Number of Non-Detects	2
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	23	Minimum Non-Detect	21
Maximum Detect	8400	Maximum Non-Detect	1100
Variance Detects	17160826	Percent Non-Detects	33.33%
Mean Detects	2187	SD Detects	4143
Median Detects	162.5	CV Detects	1.894
Skewness Detects	1.998	Kurtosis Detects	3.995
Mean of Logged Detects	5.583	SD of Logged Detects	2.48

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.645	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.436	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1477	KM Standard Error of Mean	1460
KM SD	3097	95% KM (BCA) UCL	N/A
95% KM (t) UCL	4419	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	3878	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	5857	95% KM Chebyshev UCL	7841
97.5% KM Chebyshev UCL	10594	99% KM Chebyshev UCL	16003

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.555	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.701	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.403	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.417	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.323	k star (bias corrected MLE)	0.247
Theta hat (MLE)	6764	Theta star (bias corrected MLE)	8837
nu hat (MLE)	2.586	nu star (bias corrected)	1.98
Mean (detects)	2187		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1458
Maximum	8400	Median	81.5
SD	3402	CV	2.333
k hat (MLE)	0.151	k star (bias corrected MLE)	0.186
Theta hat (MLE)	9677	Theta star (bias corrected MLE)	7820
nu hat (MLE)	1.808	nu star (bias corrected)	2.237
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (2.24, α)	0.188	Adjusted Chi Square Value (2.24, β)	0.0955
95% Gamma Approximate UCL (use when n>=50)	17375	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1477	SD (KM)	3097
Variance (KM)	9590256	SE of Mean (KM)	1460
k hat (KM)	0.227	k star (KM)	0.225
nu hat (KM)	2.729	nu star (KM)	2.698
theta hat (KM)	6494	theta star (KM)	6569
80% gamma percentile (KM)	2058	90% gamma percentile (KM)	4458
95% gamma percentile (KM)	7372	99% gamma percentile (KM)	15248

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (2.70, α)	0.289	Adjusted Chi Square Value (2.70, β)	0.131
95% Gamma Approximate KM-UCL (use when n>=50)	13794	95% Gamma Adjusted KM-UCL (use when n<50)	30385

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.308	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1464	Mean in Log Scale	4.353
SD in Original Scale	3399	SD in Log Scale	2.918
95% t UCL (assumes normality of ROS data)	4260	95% Percentile Bootstrap UCL	4230
95% BCA Bootstrap UCL	4270	95% Bootstrap t UCL	91348
95% H-UCL (Log ROS)	1.068E+10		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.911	KM Geo Mean	135.7
KM SD (logged)	2.059	95% Critical H Value (KM-Log)	7.917
KM Standard Error of Mean (logged)	0.994	95% H-UCL (KM -Log)	1654589
KM SD (logged)	2.059	95% Critical H Value (KM-Log)	7.917
KM Standard Error of Mean (logged)	0.994		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1551	Mean in Log Scale	5.166
SD in Original Scale	3361	SD in Log Scale	2.383
95% t UCL (Assumes normality)	4316	95% H-Stat UCL	49236554

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	N/A	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	30385

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	8.3	Minimum Non-Detect	390
Maximum Detect	2700	Maximum Non-Detect	390
Variance Detects	1376690	Percent Non-Detects	16.67%
Mean Detects	603.3	SD Detects	1173
Median Detects	120	CV Detects	1.945
Skewness Detects	2.225	Kurtosis Detects	4.959
Mean of Logged Detects	4.724	SD of Logged Detects	2.102

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.596	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.454	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	515.9	KM Standard Error of Mean	446.5
KM SD	978	95% KM (BCA) UCL	1382
95% KM (t) UCL	1416	95% KM (Percentile Bootstrap) UCL	1379
95% KM (z) UCL	1250	95% KM Bootstrap t UCL	11083
90% KM Chebyshev UCL	1855	95% KM Chebyshev UCL	2462
97.5% KM Chebyshev UCL	3304	99% KM Chebyshev UCL	4959

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.544	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.371	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.376	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.393	k star (bias corrected MLE)	0.291
Theta hat (MLE)	1535	Theta star (bias corrected MLE)	2076
nu hat (MLE)	3.931	nu star (bias corrected)	2.906
Mean (detects)	603.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	1.068	Mean	502.9
Maximum	2700	Median	84
SD	1078	CV	2.143
k hat (MLE)	0.303	k star (bias corrected MLE)	0.263
Theta hat (MLE)	1660	Theta star (bias corrected MLE)	1915
nu hat (MLE)	3.635	nu star (bias corrected)	3.151
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (3.15, α)	0.418	Adjusted Chi Square Value (3.15, β)	0.189
95% Gamma Approximate UCL (use when n>=50)	3787	95% Gamma Adjusted UCL (use when n<50)	8389

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	515.9	SD (KM)	978
Variance (KM)	956429	SE of Mean (KM)	446.5
k hat (KM)	0.278	k star (KM)	0.25
nu hat (KM)	3.339	nu star (KM)	3.003
theta hat (KM)	1854	theta star (KM)	2062
80% gamma percentile (KM)	749.5	90% gamma percentile (KM)	1548
95% gamma percentile (KM)	2496	99% gamma percentile (KM)	5020

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.00, α)	0.373	Adjusted Chi Square Value (3.00, β)	0.168
95% Gamma Approximate KM-UCL (use when n>=50)	4150	95% Gamma Adjusted KM-UCL (use when n<50)	9241

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.259	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	512.2	Mean in Log Scale	4.61
SD in Original Scale	1073	SD in Log Scale	1.9
95% t UCL (assumes normality of ROS data)	1395	95% Percentile Bootstrap UCL	1373
95% BCA Bootstrap UCL	1413	95% Bootstrap t UCL	13671
95% H-UCL (Log ROS)	311828		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.591	KM Geo Mean	98.61
KM SD (logged)	1.801	95% Critical H Value (KM-Log)	6.972
KM Standard Error of Mean (logged)	0.855	95% H-UCL (KM -Log)	137061
KM SD (logged)	1.801	95% Critical H Value (KM-Log)	6.972
KM Standard Error of Mean (logged)	0.855		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	535.2	Mean in Log Scale	4.815
SD in Original Scale	1063	SD in Log Scale	1.893
95% t UCL (Assumes normality)	1409	95% H-Stat UCL	361049

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	11083	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	9241

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Number of Detects	5	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	14	Minimum Non-Detect	410
Maximum Detect	7600	Maximum Non-Detect	410
Variance Detects	10848134	Percent Non-Detects	16.67%
Mean Detects	1718	SD Detects	3294
Median Detects	370	CV Detects	1.917
Skewness Detects	2.218	Kurtosis Detects	4.935
Mean of Logged Detects	5.692	SD of Logged Detects	2.289

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.606	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.446	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1460	KM Standard Error of Mean	1256
KM SD	2751	95% KM (BCA) UCL	3943
95% KM (t) UCL	3991	95% KM (Percentile Bootstrap) UCL	3860
95% KM (z) UCL	3526	95% KM Bootstrap t UCL	26085
90% KM Chebyshev UCL	5228	95% KM Chebyshev UCL	6935
97.5% KM Chebyshev UCL	9304	99% KM Chebyshev UCL	13958

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.429	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.331	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.377	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.378	k star (bias corrected MLE)	0.285
Theta hat (MLE)	4544	Theta star (bias corrected MLE)	6037
nu hat (MLE)	3.78	nu star (bias corrected)	2.845
Mean (detects)	1718		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1432
Maximum	7600	Median	245
SD	3028	CV	2.115
k hat (MLE)	0.22	k star (bias corrected MLE)	0.221
Theta hat (MLE)	6499	Theta star (bias corrected MLE)	6470
nu hat (MLE)	2.643	nu star (bias corrected)	2.655
Adjusted Level of Significance (β)	0.0122		
Approximate Chi Square Value (2.65, α)	0.278	Adjusted Chi Square Value (2.65, β)	0.127
95% Gamma Approximate UCL (use when n>=50)	13672	95% Gamma Adjusted UCL (use when n<50)	29970

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1460	SD (KM)	2751
Variance (KM)	7569396	SE of Mean (KM)	1256
k hat (KM)	0.281	k star (KM)	0.252
nu hat (KM)	3.377	nu star (KM)	3.022
theta hat (KM)	5186	theta star (KM)	5796
80% gamma percentile (KM)	2125	90% gamma percentile (KM)	4379
95% gamma percentile (KM)	7049	99% gamma percentile (KM)	14152

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.02, α)	0.379	Adjusted Chi Square Value (3.02, β)	0.17
95% Gamma Approximate KM-UCL (use when n>=50)	11640	95% Gamma Adjusted KM-UCL (use when n<50)	25909

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.215	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1444	Mean in Log Scale	5.468
SD in Original Scale	3021	SD in Log Scale	2.12
95% t UCL (assumes normality of ROS data)	3930	95% Percentile Bootstrap UCL	3846
95% BCA Bootstrap UCL	4004	95% Bootstrap t UCL	30301
95% H-UCL (Log ROS)	5026109		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.484	KM Geo Mean	240.9
KM SD (logged)	2.004	95% Critical H Value (KM-Log)	7.715
KM Standard Error of Mean (logged)	0.96	95% H-UCL (KM -Log)	1803536
KM SD (logged)	2.004	95% Critical H Value (KM-Log)	7.715
KM Standard Error of Mean (logged)	0.96		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1466	Mean in Log Scale	5.631
SD in Original Scale	3010	SD in Log Scale	2.053
95% t UCL (Assumes normality)	3942	95% H-Stat UCL	3216253

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	26085	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	25909

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Minimum	4.1	Mean	9.158
Maximum	15	Median	8.725
SD	4.15	Std. Error of Mean	1.694
Coefficient of Variation	0.453	Skewness	0.245

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.243	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	12.57	95% Adjusted-CLT UCL (Chen-1995)	12.13
		95% Modified-t UCL (Johnson-1978)	12.6

Gamma GOF Test

A-D Test Statistic	0.32	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.235	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.464	k star (bias corrected MLE)	2.843
Theta hat (MLE)	1.676	Theta star (bias corrected MLE)	3.221
nu hat (MLE)	65.56	nu star (bias corrected)	34.12
MLE Mean (bias corrected)	9.158	MLE Sd (bias corrected)	5.432
		Approximate Chi Square Value (0.05)	21.76
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	18.28

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	14.36	95% Adjusted Gamma UCL (use when n<50)	17.09

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.215	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.411	Mean of logged Data	2.12
Maximum of Logged Data	2.708	SD of logged Data	0.489

Assuming Lognormal Distribution

95% H-UCL	16.62	90% Chebyshev (MVUE) UCL	14.69
95% Chebyshev (MVUE) UCL	17.18	97.5% Chebyshev (MVUE) UCL	20.63
99% Chebyshev (MVUE) UCL	27.42		

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	11.95	95% Jackknife UCL	12.57
95% Standard Bootstrap UCL	11.64	95% Bootstrap-t UCL	13.49
95% Hall's Bootstrap UCL	11.61	95% Percentile Bootstrap UCL	11.68
95% BCA Bootstrap UCL	11.73		
90% Chebyshev(Mean, Sd) UCL	14.24	95% Chebyshev(Mean, Sd) UCL	16.54
97.5% Chebyshev(Mean, Sd) UCL	19.74	99% Chebyshev(Mean, Sd) UCL	26.02

Suggested UCL to Use

95% Student's-t UCL	12.57

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	5
		Number of Missing Observations	1
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	3
Minimum Detect	0.42	Minimum Non-Detect	0.26
Maximum Detect	1.9	Maximum Non-Detect	0.275
Variance Detects	1.095	Percent Non-Detects	66.67%
Mean Detects	1.16	SD Detects	1.047
Median Detects	1.16	CV Detects	0.902
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.113	SD of Logged Detects	1.067

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.56	KM Standard Error of Mean	0.348
KM SD	0.602	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.26	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.132	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.603	95% KM Chebyshev UCL	2.075
97.5% KM Chebyshev UCL	2.731	99% KM Chebyshev UCL	4.019

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	2.065	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.562	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	8.26	nu star (bias corrected)	N/A
Mean (detects)	1.16		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.56	SD (KM)	0.602
Variance (KM)	0.363	SE of Mean (KM)	0.348
k hat (KM)	0.865	k star (KM)	0.544
nu hat (KM)	10.38	nu star (KM)	6.523
theta hat (KM)	0.647	theta star (KM)	1.03
80% gamma percentile (KM)	0.922	90% gamma percentile (KM)	1.489
95% gamma percentile (KM)	2.088	99% gamma percentile (KM)	3.55

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (6.52, α)	1.913	Adjusted Chi Square Value (6.52, β)	1.144
95% Gamma Approximate KM-UCL (use when n>=50)	1.91	95% Gamma Adjusted KM-UCL (use when n<50)	3.193

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.393	Mean in Log Scale	-3.278
SD in Original Scale	0.756	SD in Log Scale	2.582
95% t UCL (assumes normality of ROS data)	1.015	95% Percentile Bootstrap UCL	0.955
95% BCA Bootstrap UCL	1.025	95% Bootstrap t UCL	41.31
95% H-UCL (Log ROS)	92132		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.936	KM Geo Mean	0.392
KM SD (logged)	0.727	95% Critical H Value (KM-Log)	3.252
KM Standard Error of Mean (logged)	0.42	95% H-UCL (KM -Log)	1.47
KM SD (logged)	0.727	95% Critical H Value (KM-Log)	3.252
KM Standard Error of Mean (logged)	0.42		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.475	Mean in Log Scale	-1.382
SD in Original Scale	0.707	SD in Log Scale	1.093
95% t UCL (Assumes normality)	1.057	95% H-Stat UCL	4.026

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	2.075

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Minimum	3.5	Mean	4.942
Maximum	6.8	Median	4.525
SD	1.222	Std. Error of Mean	0.499
Coefficient of Variation	0.247	Skewness	0.677

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.947	95% Adjusted-CLT UCL (Chen-1995)	5.91
		95% Modified-t UCL (Johnson-1978)	5.97

Gamma GOF Test

A-D Test Statistic	0.315	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.226	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	20.38	k star (bias corrected MLE)	10.3
Theta hat (MLE)	0.242	Theta star (bias corrected MLE)	0.48
nu hat (MLE)	244.5	nu star (bias corrected)	123.6
MLE Mean (bias corrected)	4.942	MLE Sd (bias corrected)	1.54
		Approximate Chi Square Value (0.05)	98.93
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	90.96

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.174	95% Adjusted Gamma UCL (use when n<50)	6.715

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.208	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.253	Mean of logged Data	1.573
Maximum of Logged Data	1.917	SD of logged Data	0.242

Assuming Lognormal Distribution

95% H-UCL	6.253	90% Chebyshev (MVUE) UCL	6.404
95% Chebyshev (MVUE) UCL	7.067	97.5% Chebyshev (MVUE) UCL	7.988
99% Chebyshev (MVUE) UCL	9.796		

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.763	95% Jackknife UCL	5.947
95% Standard Bootstrap UCL	5.711	95% Bootstrap-t UCL	7.069
95% Hall's Bootstrap UCL	14.77	95% Percentile Bootstrap UCL	5.767
95% BCA Bootstrap UCL	5.842		
90% Chebyshev(Mean, Sd) UCL	6.439	95% Chebyshev(Mean, Sd) UCL	7.117
97.5% Chebyshev(Mean, Sd) UCL	8.058	99% Chebyshev(Mean, Sd) UCL	9.907

Suggested UCL to Use

95% Student's-t UCL	5.947

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Minimum	20.5	Mean	644.8
Maximum	3700	Median	38.5
SD	1497	Std. Error of Mean	611.1
Coefficient of Variation	2.322	Skewness	2.449

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.503	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.488	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1876	95% Adjusted-CLT UCL (Chen-1995)	2303
		95% Modified-t UCL (Johnson-1978)	1978

Gamma GOF Test

A-D Test Statistic	1.376	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.765	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.483	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.356	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.309	k star (bias corrected MLE)	0.266
Theta hat (MLE)	2086	Theta star (bias corrected MLE)	2427
nu hat (MLE)	3.709	nu star (bias corrected)	3.188
MLE Mean (bias corrected)	644.8	MLE Sd (bias corrected)	1251
		Approximate Chi Square Value (0.05)	0.43
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	0.195

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4778	95% Adjusted Gamma UCL (use when n<50)	10563

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.66	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.401	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.02	Mean of logged Data	4.249
Maximum of Logged Data	8.216	SD of logged Data	1.976

Assuming Lognormal Distribution

95% H-UCL	413581	90% Chebyshev (MVUE) UCL	858.8
95% Chebyshev (MVUE) UCL	1123	97.5% Chebyshev (MVUE) UCL	1491
99% Chebyshev (MVUE) UCL	2213		

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	1650	95% Jackknife UCL	1876
95% Standard Bootstrap UCL	1591	95% Bootstrap-t UCL	103674
95% Hall's Bootstrap UCL	60697	95% Percentile Bootstrap UCL	1865
95% BCA Bootstrap UCL	2476		
90% Chebyshev(Mean, Sd) UCL	2478	95% Chebyshev(Mean, Sd) UCL	3308
97.5% Chebyshev(Mean, Sd) UCL	4461	99% Chebyshev(Mean, Sd) UCL	6725

Suggested UCL to Use

95% Hall's Bootstrap UCL 60697

Recommended UCL exceeds the maximum observation

In Case Bootstrap t and/or Hall's Bootstrap yields an unreasonably large UCL value, use 97.5% or 99% Chebyshev (Mean, Sd) UCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Minimum	11000	Mean	15083
Maximum	24000	Median	13500
SD	4862	Std. Error of Mean	1985
Coefficient of Variation	0.322	Skewness	1.544

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.255	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19083	95% Adjusted-CLT UCL (Chen-1995)	19685
		95% Modified-t UCL (Johnson-1978)	19292

Gamma GOF Test

A-D Test Statistic	0.398	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	13.44	k star (bias corrected MLE)	6.83
Theta hat (MLE)	1122	Theta star (bias corrected MLE)	2208
nu hat (MLE)	161.2	nu star (bias corrected)	81.96
MLE Mean (bias corrected)	15083	MLE Sd (bias corrected)	5772
		Approximate Chi Square Value (0.05)	62.1
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	55.89

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	19908	95% Adjusted Gamma UCL (use when n<50)	22119

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.306	Mean of logged Data	9.584
Maximum of Logged Data	10.09	SD of logged Data	0.291

Assuming Lognormal Distribution

95% H-UCL	20195	90% Chebyshev (MVUE) UCL	20398
95% Chebyshev (MVUE) UCL	22823	97.5% Chebyshev (MVUE) UCL	26189
99% Chebyshev (MVUE) UCL	32802		

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	18348	95% Jackknife UCL	19083
95% Standard Bootstrap UCL	18097	95% Bootstrap-t UCL	24873
95% Hall's Bootstrap UCL	35677	95% Percentile Bootstrap UCL	18167
95% BCA Bootstrap UCL	19000		
90% Chebyshev(Mean, Sd) UCL	21038	95% Chebyshev(Mean, Sd) UCL	23736
97.5% Chebyshev(Mean, Sd) UCL	27480	99% Chebyshev(Mean, Sd) UCL	34834

Suggested UCL to Use

95% Student's-t UCL	19083

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Minimum	230	Mean	365
Maximum	560	Median	330
SD	126.9	Std. Error of Mean	51.82
Coefficient of Variation	0.348	Skewness	0.731

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.196	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	469.4	95% Adjusted-CLT UCL (Chen-1995)	466.7
		95% Modified-t UCL (Johnson-1978)	472

Gamma GOF Test

A-D Test Statistic	0.25	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.332	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	10.43	k star (bias corrected MLE)	5.324
Theta hat (MLE)	35.01	Theta star (bias corrected MLE)	68.55
nu hat (MLE)	125.1	nu star (bias corrected)	63.89
MLE Mean (bias corrected)	365	MLE Sd (bias corrected)	158.2
		Approximate Chi Square Value (0.05)	46.5
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	41.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	501.5	95% Adjusted Gamma UCL (use when n<50)	566

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.438	Mean of logged Data	5.851
Maximum of Logged Data	6.328	SD of logged Data	0.339

Assuming Lognormal Distribution

95% H-UCL	521.8	90% Chebyshev (MVUE) UCL	516.1
95% Chebyshev (MVUE) UCL	584.7	97.5% Chebyshev (MVUE) UCL	679.9
99% Chebyshev (MVUE) UCL	867		

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	450.2	95% Jackknife UCL	469.4
95% Standard Bootstrap UCL	442.8	95% Bootstrap-t UCL	537.7
95% Hall's Bootstrap UCL	581.5	95% Percentile Bootstrap UCL	446.7
95% BCA Bootstrap UCL	445		
90% Chebyshev(Mean, Sd) UCL	520.5	95% Chebyshev(Mean, Sd) UCL	590.9
97.5% Chebyshev(Mean, Sd) UCL	688.6	99% Chebyshev(Mean, Sd) UCL	880.6

Suggested UCL to Use

95% Student's-t UCL	469.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Minimum	0.1	Mean	0.254
Maximum	0.53	Median	0.223
SD	0.159	Std. Error of Mean	0.0648
Coefficient of Variation	0.625	Skewness	1.138

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.385	95% Adjusted-CLT UCL (Chen-1995)	0.393
		95% Modified-t UCL (Johnson-1978)	0.39

Gamma GOF Test

A-D Test Statistic	0.215	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.701	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.174	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.334	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.312	k star (bias corrected MLE)	1.767
Theta hat (MLE)	0.0767	Theta star (bias corrected MLE)	0.144
nu hat (MLE)	39.75	nu star (bias corrected)	21.21
MLE Mean (bias corrected)	0.254	MLE Sd (bias corrected)	0.191
		Approximate Chi Square Value (0.05)	11.75
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	9.311

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.459	95% Adjusted Gamma UCL (use when n<50)	0.579

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.303	Mean of logged Data	-1.528
Maximum of Logged Data	-0.635	SD of logged Data	0.617

Assuming Lognormal Distribution

95% H-UCL	0.591	90% Chebyshev (MVUE) UCL	0.444
95% Chebyshev (MVUE) UCL	0.531	97.5% Chebyshev (MVUE) UCL	0.651
99% Chebyshev (MVUE) UCL	0.887		

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.361	95% Jackknife UCL	0.385
95% Standard Bootstrap UCL	0.351	95% Bootstrap-t UCL	0.484
95% Hall's Bootstrap UCL	0.466	95% Percentile Bootstrap UCL	0.358
95% BCA Bootstrap UCL	0.39		
90% Chebyshev(Mean, Sd) UCL	0.449	95% Chebyshev(Mean, Sd) UCL	0.537
97.5% Chebyshev(Mean, Sd) UCL	0.659	99% Chebyshev(Mean, Sd) UCL	0.899

Suggested UCL to Use

95% Student's-t UCL	0.385

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Minimum	16	Mean	26.92
Maximum	60	Median	19.25
SD	17	Std. Error of Mean	6.941
Coefficient of Variation	0.632	Skewness	2.01

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.72	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.303	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	40.9	95% Adjusted-CLT UCL (Chen-1995)	44.42
		95% Modified-t UCL (Johnson-1978)	41.85

Gamma GOF Test

A-D Test Statistic	0.686	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.292	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.168	k star (bias corrected MLE)	2.195
Theta hat (MLE)	6.458	Theta star (bias corrected MLE)	12.26
nu hat (MLE)	50.01	nu star (bias corrected)	26.34
MLE Mean (bias corrected)	26.92	MLE Sd (bias corrected)	18.17
		Approximate Chi Square Value (0.05)	15.64
Adjusted Level of Significance	0.0122	Adjusted Chi Square Value	12.76

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	45.33	95% Adjusted Gamma UCL (use when n<50)	55.55

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.815	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.788	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.325	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.773	Mean of logged Data	3.168
Maximum of Logged Data	4.094	SD of logged Data	0.508

Assuming Lognormal Distribution

95% H-UCL	49.42	90% Chebyshev (MVUE) UCL	42.82
95% Chebyshev (MVUE) UCL	50.25	97.5% Chebyshev (MVUE) UCL	60.57
99% Chebyshev (MVUE) UCL	80.83		

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	38.33	95% Jackknife UCL	40.9
95% Standard Bootstrap UCL	37.41	95% Bootstrap-t UCL	94.35
95% Hall's Bootstrap UCL	101.5	95% Percentile Bootstrap UCL	39
95% BCA Bootstrap UCL	41.42		
90% Chebyshev(Mean, Sd) UCL	47.74	95% Chebyshev(Mean, Sd) UCL	57.17
97.5% Chebyshev(Mean, Sd) UCL	70.26	99% Chebyshev(Mean, Sd) UCL	95.98

Suggested UCL to Use

95% Student's-t UCL	40.9

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	6	Number of Distinct Observations	6
		Number of Missing Observations	1
Number of Detects	2	Number of Non-Detects	4
Number of Distinct Detects	2	Number of Distinct Non-Detects	4
Minimum Detect	41	Minimum Non-Detect	24
Maximum Detect	170	Maximum Non-Detect	260
Variance Detects	8321	Percent Non-Detects	66.67%
Mean Detects	105.5	SD Detects	91.22
Median Detects	105.5	CV Detects	0.865
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	4.425	SD of Logged Detects	1.006

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	56.6	KM Standard Error of Mean	36.1
KM SD	57.08	95% KM (BCA) UCL	N/A
95% KM (t) UCL	129.3	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	116	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	164.9	95% KM Chebyshev UCL	214
97.5% KM Chebyshev UCL	282.1	99% KM Chebyshev UCL	415.8

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	2.289	k star (bias corrected MLE)	N/A
Theta hat (MLE)	46.08	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	9.157	nu star (bias corrected)	N/A
Mean (detects)	105.5		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	56.6	SD (KM)	57.08
Variance (KM)	3258	SE of Mean (KM)	36.1
k hat (KM)	0.983	k star (KM)	0.603
nu hat (KM)	11.8	nu star (KM)	7.233
theta hat (KM)	57.57	theta star (KM)	93.91
80% gamma percentile (KM)	93.29	90% gamma percentile (KM)	147.1
95% gamma percentile (KM)	203.3	99% gamma percentile (KM)	339.4

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0122
Approximate Chi Square Value (7.23, α)	2.299	Adjusted Chi Square Value (7.23, β)	1.427
95% Gamma Approximate KM-UCL (use when n>=50)	178.1	95% Gamma Adjusted KM-UCL (use when n<50)	287

Table B.7.2

Summary of ProUCL Output for EU09 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 9:37:24 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	37	Mean in Log Scale	1.976
SD in Original Scale	66.96	SD in Log Scale	2.038
95% t UCL (assumes normality of ROS data)	92.08	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	72755		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.677	KM Geo Mean	39.52
KM SD (logged)	0.758	95% Critical H Value (KM-Log)	3.347
KM Standard Error of Mean (logged)	0.48	95% H-UCL (KM -Log)	164
KM SD (logged)	0.758	95% Critical H Value (KM-Log)	3.347
KM Standard Error of Mean (logged)	0.48		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	63.04	Mean in Log Scale	3.546
SD in Original Scale	69.42	SD in Log Scale	1.222
95% t UCL (Assumes normality)	120.2	95% H-Stat UCL	1063

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL 214

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.3

Summary of ProUCL Input Data for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene
on-site (EU09)	SS-86	11/2/2017	0-2 ft BGS	0.47	0	27000	1	17000	1	25000	1	8400	1	2700	1
on-site (EU09)	SS-87	10/31/2018	0.5-2.5 ft BGS	0.695	0	925	1	915	1	1300	1	185	1	140	1
on-site (EU09)	SS-88	10/31/2018	0.5-2.5 ft BGS												
on-site (EU09)	SS-90	10/31/2018	0.17-2.17 ft BGS	0.72	0	34	1	35	1	56	1	23	1	8.3	1
on-site (EU09)	SS-91	10/31/2018	0.5-2.5 ft BGS	0.62	0	720	1	690	1	970	1	140	1	120	1
on-site (EU09)	SS-92	10/31/2018	0-2 ft BGS	4.3	1	190	0	520	0	600	1	1100	0	390	0
on-site (EU09)	SS-93	10/31/2018	0-2 ft BGS	0.69	0	100	1	84	1	340	1	21	0	48	1
on-site (EU09)	SS-161-AS	10/31/2018	0.5-1 ft BGS												
on-site (EU09)	SS-162-AS	10/31/2018	0.17-0.67 ft BGS												
on-site (EU09)	BH120-18	1/19/2018	8-10 ft BGS	0.3	0	34	1	47	1	84	1	32	0	14	1
on-site (EU09)	BH121-18	1/19/2018	8-10 ft BGS	0.35	0	520	1	350	1	540	1	60	1	54	1
on-site (EU09)	TP-17	11/2/2017	8-10 ft BGS	0.7	0	290	1	210	1	400	1	54	1	30	1
on-site (EU09)	TT-13	9/25/2008	7 ft BGS	4.7	0							52	0	7	0
on-site (EU09)	TT-13	9/25/2008	7- ft BGS			110	1	99	1	140	1				
on-site (EU09)	VAS-21B	6/2/2009	3-5 ft BGS	4.3	0	360	1	410	1	480	1	550	0	74	0

Table B.7.3

Summary of ProUCL Input Data for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum	D_Aluminum	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper
on-site (EU09)	SS-86	11/2/2017	0-2 ft BGS	7600	1	6500	1	15	1	1.9	1	6.8	1	37	1
on-site (EU09)	SS-87	10/31/2018	0.5-2.5 ft BGS	485	1	6350	1	6.45	1	0.275	0	4.35	1	20.5	1
on-site (EU09)	SS-88	10/31/2018	0.5-2.5 ft BGS												
on-site (EU09)	SS-90	10/31/2018	0.17-2.17 ft BGS	14	1	4700	1	4.1	1	0.42	1	4.3	1	3700	1
on-site (EU09)	SS-91	10/31/2018	0.5-2.5 ft BGS	370	1	4800	1	6.4	1	0.26	0	3.5	1	21	1
on-site (EU09)	SS-92	10/31/2018	0-2 ft BGS	410	0	7000	1	11	1	0.27	0	6	1	40	1
on-site (EU09)	SS-93	10/31/2018	0-2 ft BGS	120	1	4600	1	12	1	0.26	0	4.7	1	50	1
on-site (EU09)	SS-161-AS	10/31/2018	0.5-1 ft BGS												
on-site (EU09)	SS-162-AS	10/31/2018	0.17-0.67 ft BGS												
on-site (EU09)	BH120-18	1/19/2018	8-10 ft BGS	38	1	9300	1	12	1	1.4	0	8.4	1	18	1
on-site (EU09)	BH121-18	1/19/2018	8-10 ft BGS	160	1	6500	1	16	1	1.4	0	9.8	1	4700	1
on-site (EU09)	TP-17	11/2/2017	8-10 ft BGS	67	1	3100	1	7.5	1	1.1	1	3.9	1	19	1
on-site (EU09)	TT-13	9/25/2008	7 ft BGS												
on-site (EU09)	TT-13	9/25/2008	7- ft BGS	59	1	3720	1	4.2	1	0.9	1	3.5	1	12	1
on-site (EU09)	VAS-21B	6/2/2009	3-5 ft BGS	300	1	5450	1	7.6	1	1.8	1	4.7	1	66.7	1

Table B.7.3

Summary of ProUCL Input Data for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				24	25	26	27	28	29	30	31	32	33	34	35	36	37
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU09)	SS-86	11/2/2017	0-2 ft BGS	0.51	0	13000	1	58	1	270	1	0.53	1	30	1	41	1
on-site (EU09)	SS-87	10/31/2018	0.5-2.5 ft BGS	0.215	0	11500	1	32	1	360	1	0.175	1	17.5	1	25.5	0
on-site (EU09)	SS-88	10/31/2018	0.5-2.5 ft BGS	-													
on-site (EU09)	SS-90	10/31/2018	0.17-2.17 ft BGS	0.22	0	17000	1	210	1	300	1	0.1	1	60	1	24	0
on-site (EU09)	SS-91	10/31/2018	0.5-2.5 ft BGS	0.19	0	24000	1	42	1	560	1	0.13	1	16	1	170	1
on-site (EU09)	SS-92	10/31/2018	0-2 ft BGS	0.21	0	14000	1	310	1	470	1	0.27	1	21	1	260	0
on-site (EU09)	SS-93	10/31/2018	0-2 ft BGS	0.23	1	11000	1	150	1	230	1	0.32	1	17	1	25	0
on-site (EU09)	SS-161-AS	10/31/2018	0.5-1 ft BGS														
on-site (EU09)	SS-162-AS	10/31/2018	0.17-0.67 ft BGS														
on-site (EU09)	BH120-18	1/19/2018	8-10 ft BGS	0.088	0	17000	1	23	1	810	1	0.21	1	23	1	50	1
on-site (EU09)	BH121-18	1/19/2018	8-10 ft BGS	7.1	1	59000	1	680	1	700	1	0.14	1	18	1	27	0
on-site (EU09)	TP-17	11/2/2017	8-10 ft BGS	0.54	1	6900	1	29	1	230	1	0.34	1	13	1	17	0
on-site (EU09)	TT-13	9/25/2008	7 ft BGS	0.52	0							0.1	0			35	0
on-site (EU09)	TT-13	9/25/2008	7- ft BGS			7740	1	12.5	1	256	1			12.3	1		
on-site (EU09)	VAS-21B	6/2/2009	3-5 ft BGS			11300	1	124	1	362	1	0.19	1	17.1	1	37	0

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	4
Number of Detects	1	Number of Non-Detects	10
Number of Distinct Detects	1	Number of Distinct Non-Detects	10

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,1-Dichloroethane was not processed!

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	4
Number of Detects	10	Number of Non-Detects	1
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	34	Minimum Non-Detect	190
Maximum Detect	27000	Maximum Non-Detect	190
Variance Detects	71147075	Percent Non-Detects	9.091%
Mean Detects	3009	SD Detects	8435
Median Detects	325	CV Detects	2.803
Skewness Detects	3.155	Kurtosis Detects	9.965
Mean of Logged Detects	5.778	SD of Logged Detects	1.951

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.398	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.498	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2742	KM Standard Error of Mean	2440
KM SD	7676	95% KM (BCA) UCL	7650
95% KM (t) UCL	7164	95% KM (Percentile Bootstrap) UCL	7573
95% KM (z) UCL	6755	95% KM Bootstrap t UCL	95587
90% KM Chebyshev UCL	10061	95% KM Chebyshev UCL	13376
97.5% KM Chebyshev UCL	17978	99% KM Chebyshev UCL	27017

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.412	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.812	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.372	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.288	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.308	k star (bias corrected MLE)	0.282
Theta hat (MLE)	9778	Theta star (bias corrected MLE)	10668
nu hat (MLE)	6.155	nu star (bias corrected)	5.642
Mean (detects)	3009		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2736
Maximum	27000	Median	290
SD	8053	CV	2.944
k hat (MLE)	0.233	k star (bias corrected MLE)	0.23
Theta hat (MLE)	11731	Theta star (bias corrected MLE)	11884
nu hat (MLE)	5.13	nu star (bias corrected)	5.065
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (5.06, α)	1.182	Adjusted Chi Square Value (5.06, β)	0.908
95% Gamma Approximate UCL (use when n>=50)	11721	95% Gamma Adjusted UCL (use when n<50)	15261

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2742	SD (KM)	7676
Variance (KM)	58925609	SE of Mean (KM)	2440
k hat (KM)	0.128	k star (KM)	0.153
nu hat (KM)	2.807	nu star (KM)	3.375
theta hat (KM)	21490	theta star (KM)	17875
80% gamma percentile (KM)	3039	90% gamma percentile (KM)	8155
95% gamma percentile (KM)	15025	99% gamma percentile (KM)	34870

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.37, α)	0.492	Adjusted Chi Square Value (3.37, β)	0.35
95% Gamma Approximate KM-UCL (use when n>=50)	18823	95% Gamma Adjusted KM-UCL (use when n<50)	26441

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2741	Mean in Log Scale	5.622
SD in Original Scale	8051	SD in Log Scale	1.922
95% t UCL (assumes normality of ROS data)	7141	95% Percentile Bootstrap UCL	7551
95% BCA Bootstrap UCL	10024	95% Bootstrap t UCL	93004
95% H-UCL (Log ROS)	36052		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.625	KM Geo Mean	277.2
KM SD (logged)	1.838	95% Critical H Value (KM-Log)	4.786
KM Standard Error of Mean (logged)	0.587	95% H-UCL (KM -Log)	24247
KM SD (logged)	1.838	95% Critical H Value (KM-Log)	4.786
KM Standard Error of Mean (logged)	0.587		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2744	Mean in Log Scale	5.667
SD in Original Scale	8050	SD in Log Scale	1.887
95% t UCL (Assumes normality)	7144	95% H-Stat UCL	31911

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	17978	99% KM (Chebyshev) UCL	27017

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	4
Number of Detects	10	Number of Non-Detects	1
Number of Distinct Detects	10	Number of Distinct Non-Detects	1
Minimum Detect	35	Minimum Non-Detect	520
Maximum Detect	17000	Maximum Non-Detect	520
Variance Detects	27922862	Percent Non-Detects	9.091%
Mean Detects	1984	SD Detects	5284
Median Detects	280	CV Detects	2.663
Skewness Detects	3.144	Kurtosis Detects	9.915
Mean of Logged Detects	5.675	SD of Logged Detects	1.807

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.414	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.48	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1820	KM Standard Error of Mean	1528
KM SD	4808	95% KM (BCA) UCL	4860
95% KM (t) UCL	4589	95% KM (Percentile Bootstrap) UCL	4825
95% KM (z) UCL	4333	95% KM Bootstrap t UCL	42451
90% KM Chebyshev UCL	6404	95% KM Chebyshev UCL	8481
97.5% KM Chebyshev UCL	11363	99% KM Chebyshev UCL	17025

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.279	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.804	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.331	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.286	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.351	k star (bias corrected MLE)	0.312
Theta hat (MLE)	5660	Theta star (bias corrected MLE)	6358
nu hat (MLE)	7.01	nu star (bias corrected)	6.241
Mean (detects)	1984		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1804
Maximum	17000	Median	210
SD	5049	CV	2.799
k hat (MLE)	0.257	k star (bias corrected MLE)	0.247
Theta hat (MLE)	7031	Theta star (bias corrected MLE)	7297
nu hat (MLE)	5.644	nu star (bias corrected)	5.438
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (5.44, α)	1.36	Adjusted Chi Square Value (5.44, β)	1.058
95% Gamma Approximate UCL (use when n>=50)	7213	95% Gamma Adjusted UCL (use when n<50)	9272

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1820	SD (KM)	4808
Variance (KM)	23117784	SE of Mean (KM)	1528
k hat (KM)	0.143	k star (KM)	0.165
nu hat (KM)	3.151	nu star (KM)	3.625
theta hat (KM)	12704	theta star (KM)	11043
80% gamma percentile (KM)	2129	90% gamma percentile (KM)	5454
95% gamma percentile (KM)	9823	99% gamma percentile (KM)	22267

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.63, α)	0.579	Adjusted Chi Square Value (3.63, β)	0.417
95% Gamma Approximate KM-UCL (use when n>=50)	11384	95% Gamma Adjusted KM-UCL (use when n<50)	15801

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.163	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1816	Mean in Log Scale	5.605
SD in Original Scale	5044	SD in Log Scale	1.729
95% t UCL (assumes normality of ROS data)	4572	95% Percentile Bootstrap UCL	4804
95% BCA Bootstrap UCL	6396	95% Bootstrap t UCL	41928
95% H-UCL (Log ROS)	14533		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.596	KM Geo Mean	269.4
KM SD (logged)	1.675	95% Critical H Value (KM-Log)	4.418
KM Standard Error of Mean (logged)	0.54	95% H-UCL (KM -Log)	11363
KM SD (logged)	1.675	95% Critical H Value (KM-Log)	4.418
KM Standard Error of Mean (logged)	0.54		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1827	Mean in Log Scale	5.665
SD in Original Scale	5040	SD in Log Scale	1.714
95% t UCL (Assumes normality)	4581	95% H-Stat UCL	14432

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	11363	99% KM (Chebyshev) UCL	17025

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	4
Minimum	56	Mean	2719
Maximum	25000	Median	480
SD	7399	Std. Error of Mean	2231
Coefficient of Variation	2.721	Skewness	3.301

Normal GOF Test

Shapiro Wilk Test Statistic	0.39	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.485	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6763	95% Adjusted-CLT UCL (Chen-1995)	8761
		95% Modified-t UCL (Johnson-1978)	7133

Gamma GOF Test

A-D Test Statistic	1.586	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.803	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.352	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.273	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.388	k star (bias corrected MLE)	0.343
Theta hat (MLE)	7004	Theta star (bias corrected MLE)	7928
nu hat (MLE)	8.541	nu star (bias corrected)	7.545
MLE Mean (bias corrected)	2719	MLE Sd (bias corrected)	4643
		Approximate Chi Square Value (0.05)	2.475
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	2.028

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8291	95% Adjusted Gamma UCL (use when n<50)	10118

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.186	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.025	Mean of logged Data	6.205
Maximum of Logged Data	10.13	SD of logged Data	1.628

Assuming Lognormal Distribution

95% H-UCL	17142	90% Chebyshev (MVUE) UCL	3861
95% Chebyshev (MVUE) UCL	4933	97.5% Chebyshev (MVUE) UCL	6420
99% Chebyshev (MVUE) UCL	9342		

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6389	95% Jackknife UCL	6763
95% Standard Bootstrap UCL	6104	95% Bootstrap-t UCL	68299
95% Hall's Bootstrap UCL	34639	95% Percentile Bootstrap UCL	7135
95% BCA Bootstrap UCL	9404		
90% Chebyshev(Mean, Sd) UCL	9412	95% Chebyshev(Mean, Sd) UCL	12444
97.5% Chebyshev(Mean, Sd) UCL	16651	99% Chebyshev(Mean, Sd) UCL	24917

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	24917

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	4
Number of Detects	6	Number of Non-Detects	5
Number of Distinct Detects	6	Number of Distinct Non-Detects	5
Minimum Detect	23	Minimum Non-Detect	21
Maximum Detect	8400	Maximum Non-Detect	1100
Variance Detects	11506339	Percent Non-Detects	45.45%
Mean Detects	1477	SD Detects	3392
Median Detects	100	CV Detects	2.297
Skewness Detects	2.448	Kurtosis Detects	5.993
Mean of Logged Detects	5.069	SD of Logged Detects	2.08

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.513	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.482	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	823.5	KM Standard Error of Mean	791.6
KM SD	2397	95% KM (BCA) UCL	2343
95% KM (t) UCL	2258	95% KM (Percentile Bootstrap) UCL	2335
95% KM (z) UCL	2126	95% KM Bootstrap t UCL	42977
90% KM Chebyshev UCL	3198	95% KM Chebyshev UCL	4274
97.5% KM Chebyshev UCL	5767	99% KM Chebyshev UCL	8700

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.051	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.765	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.428	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.356	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.308	k star (bias corrected MLE)	0.265
Theta hat (MLE)	4794	Theta star (bias corrected MLE)	5570
nu hat (MLE)	3.697	nu star (bias corrected)	3.182
Mean (detects)	1477		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	805.6
Maximum	8400	Median	23
SD	2520	CV	3.127
k hat (MLE)	0.13	k star (bias corrected MLE)	0.155
Theta hat (MLE)	6185	Theta star (bias corrected MLE)	5186
nu hat (MLE)	2.866	nu star (bias corrected)	3.418
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (3.42, α)	0.506	Adjusted Chi Square Value (3.42, β)	0.361
95% Gamma Approximate UCL (use when n>=50)	5440	95% Gamma Adjusted UCL (use when n<50)	7626

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	823.5	SD (KM)	2397
Variance (KM)	5743433	SE of Mean (KM)	791.6
k hat (KM)	0.118	k star (KM)	0.146
nu hat (KM)	2.598	nu star (KM)	3.223
theta hat (KM)	6974	theta star (KM)	5622
80% gamma percentile (KM)	878.9	90% gamma percentile (KM)	2434
95% gamma percentile (KM)	4553	99% gamma percentile (KM)	10734

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.22, α)	0.441	Adjusted Chi Square Value (3.22, β)	0.312
95% Gamma Approximate KM-UCL (use when n>=50)	6014	95% Gamma Adjusted KM-UCL (use when n<50)	8503

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.821	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.304	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	811.4	Mean in Log Scale	3.66
SD in Original Scale	2518	SD in Log Scale	2.335
95% t UCL (assumes normality of ROS data)	2187	95% Percentile Bootstrap UCL	2321
95% BCA Bootstrap UCL	3097	95% Bootstrap t UCL	50420
95% H-UCL (Log ROS)	47092		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.299	KM Geo Mean	73.65
KM SD (logged)	1.692	95% Critical H Value (KM-Log)	4.458
KM Standard Error of Mean (logged)	0.574	95% H-UCL (KM -Log)	3351
KM SD (logged)	1.692	95% Critical H Value (KM-Log)	4.458
KM Standard Error of Mean (logged)	0.574		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	885.4	Mean in Log Scale	4.611
SD in Original Scale	2498	SD in Log Scale	1.926
95% t UCL (Assumes normality)	2250	95% H-Stat UCL	13408

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	8700

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	4
Number of Detects	8	Number of Non-Detects	3
Number of Distinct Detects	8	Number of Distinct Non-Detects	3
Minimum Detect	8.3	Minimum Non-Detect	7
Maximum Detect	2700	Maximum Non-Detect	390
Variance Detects	874004	Percent Non-Detects	27.27%
Mean Detects	389.3	SD Detects	934.9
Median Detects	51	CV Detects	2.402
Skewness Detects	2.814	Kurtosis Detects	7.938
Mean of Logged Detects	4.206	SD of Logged Detects	1.779

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.464	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.48	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	290.7	KM Standard Error of Mean	246
KM SD	763.2	95% KM (BCA) UCL	760.5
95% KM (t) UCL	736.7	95% KM (Percentile Bootstrap) UCL	765.1
95% KM (z) UCL	695.4	95% KM Bootstrap t UCL	5570
90% KM Chebyshev UCL	1029	95% KM Chebyshev UCL	1363
97.5% KM Chebyshev UCL	1827	99% KM Chebyshev UCL	2739

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.071	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.784	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.365	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.314	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.378	k star (bias corrected MLE)	0.319
Theta hat (MLE)	1031	Theta star (bias corrected MLE)	1219
nu hat (MLE)	6.043	nu star (bias corrected)	5.11
Mean (detects)	389.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	283.1
Maximum	2700	Median	30
SD	803	CV	2.836
k hat (MLE)	0.193	k star (bias corrected MLE)	0.201
Theta hat (MLE)	1470	Theta star (bias corrected MLE)	1411
nu hat (MLE)	4.238	nu star (bias corrected)	4.415
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (4.42, α)	0.892	Adjusted Chi Square Value (4.42, β)	0.668
95% Gamma Approximate UCL (use when n>=50)	1401	95% Gamma Adjusted UCL (use when n<50)	1872

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	290.7	SD (KM)	763.2
Variance (KM)	582398	SE of Mean (KM)	246
k hat (KM)	0.145	k star (KM)	0.166
nu hat (KM)	3.193	nu star (KM)	3.655
theta hat (KM)	2003	theta star (KM)	1750
80% gamma percentile (KM)	342.1	90% gamma percentile (KM)	872
95% gamma percentile (KM)	1567	99% gamma percentile (KM)	3542

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.66, α)	0.59	Adjusted Chi Square Value (3.66, β)	0.426
95% Gamma Approximate KM-UCL (use when n>=50)	1800	95% Gamma Adjusted KM-UCL (use when n<50)	2494

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.215	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	287.5	Mean in Log Scale	3.657
SD in Original Scale	801.4	SD in Log Scale	1.902
95% t UCL (assumes normality of ROS data)	725.4	95% Percentile Bootstrap UCL	766.1
95% BCA Bootstrap UCL	1018	95% Bootstrap t UCL	6626
95% H-UCL (Log ROS)	4591		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.818	KM Geo Mean	45.5
KM SD (logged)	1.637	95% Critical H Value (KM-Log)	4.334
KM Standard Error of Mean (logged)	0.547	95% H-UCL (KM -Log)	1639
KM SD (logged)	1.637	95% Critical H Value (KM-Log)	4.334
KM Standard Error of Mean (logged)	0.547		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	304.5	Mean in Log Scale	3.98
SD in Original Scale	796.8	SD in Log Scale	1.784
95% t UCL (Assumes normality)	740	95% H-Stat UCL	3645

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	1827	99% KM (Chebyshev) UCL	2739

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	4
Number of Detects	10	Number of Non-Detects	1
Number of Distinct Detects	10	Number of Distinct Non-Detects	1
Minimum Detect	14	Minimum Non-Detect	410
Maximum Detect	7600	Maximum Non-Detect	410
Variance Detects	5531533	Percent Non-Detects	9.091%
Mean Detects	921.3	SD Detects	2352
Median Detects	140	CV Detects	2.553
Skewness Detects	3.136	Kurtosis Detects	9.877
Mean of Logged Detects	5.116	SD of Logged Detects	1.734

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.425	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.474	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	850.4	KM Standard Error of Mean	680.1
KM SD	2139	95% KM (BCA) UCL	2207
95% KM (t) UCL	2083	95% KM (Percentile Bootstrap) UCL	2187
95% KM (z) UCL	1969	95% KM Bootstrap t UCL	13478
90% KM Chebyshev UCL	2891	95% KM Chebyshev UCL	3815
97.5% KM Chebyshev UCL	5098	99% KM Chebyshev UCL	7617

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.17	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.798	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.324	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.285	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.387	k star (bias corrected MLE)	0.338
Theta hat (MLE)	2381	Theta star (bias corrected MLE)	2730
nu hat (MLE)	7.738	nu star (bias corrected)	6.75
Mean (detects)	921.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	837.5
Maximum	7600	Median	120
SD	2248	CV	2.685
k hat (MLE)	0.279	k star (bias corrected MLE)	0.264
Theta hat (MLE)	2999	Theta star (bias corrected MLE)	3176
nu hat (MLE)	6.144	nu star (bias corrected)	5.801
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (5.80, α)	1.539	Adjusted Chi Square Value (5.80, β)	1.211
95% Gamma Approximate UCL (use when n>=50)	3157	95% Gamma Adjusted UCL (use when n<50)	4012

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	850.4	SD (KM)	2139
Variance (KM)	4577454	SE of Mean (KM)	680.1
k hat (KM)	0.158	k star (KM)	0.175
nu hat (KM)	3.475	nu star (KM)	3.861
theta hat (KM)	5383	theta star (KM)	4845
80% gamma percentile (KM)	1038	90% gamma percentile (KM)	2561
95% gamma percentile (KM)	4525	99% gamma percentile (KM)	10057

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.86, α)	0.668	Adjusted Chi Square Value (3.86, β)	0.487
95% Gamma Approximate KM-UCL (use when n>=50)	4918	95% Gamma Adjusted KM-UCL (use when n<50)	6747

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.169	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	846.7	Mean in Log Scale	5.07
SD in Original Scale	2245	SD in Log Scale	1.652
95% t UCL (assumes normality of ROS data)	2073	95% Percentile Bootstrap UCL	2170
95% BCA Bootstrap UCL	2889	95% Bootstrap t UCL	15076
95% H-UCL (Log ROS)	6096		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.06	KM Geo Mean	157.6
KM SD (logged)	1.608	95% Critical H Value (KM-Log)	4.269
KM Standard Error of Mean (logged)	0.521	95% H-UCL (KM -Log)	5031
KM SD (logged)	1.608	95% Critical H Value (KM-Log)	4.269
KM Standard Error of Mean (logged)	0.521		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	856.2	Mean in Log Scale	5.135
SD in Original Scale	2242	SD in Log Scale	1.646
95% t UCL (Assumes normality)	2081	95% H-Stat UCL	6346

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	5098	99% KM (Chebyshev) UCL	7617

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	4
Minimum	3100	Mean	5638
Maximum	9300	Median	5450
SD	1734	Std. Error of Mean	522.9
Coefficient of Variation	0.308	Skewness	0.64

Normal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.14	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6586	95% Adjusted-CLT UCL (Chen-1995)	6606
		95% Modified-t UCL (Johnson-1978)	6603

Gamma GOF Test

A-D Test Statistic	0.231	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.15	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	11.76	k star (bias corrected MLE)	8.615
Theta hat (MLE)	479.3	Theta star (bias corrected MLE)	654.5
nu hat (MLE)	258.8	nu star (bias corrected)	189.5
MLE Mean (bias corrected)	5638	MLE Sd (bias corrected)	1921
		Approximate Chi Square Value (0.05)	158.7
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	154.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6734	95% Adjusted Gamma UCL (use when n<50)	6935

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.039	Mean of logged Data	8.594
Maximum of Logged Data	9.138	SD of logged Data	0.31

Assuming Lognormal Distribution

95% H-UCL	6869	90% Chebyshev (MVUE) UCL	7239
95% Chebyshev (MVUE) UCL	7963	97.5% Chebyshev (MVUE) UCL	8967
99% Chebyshev (MVUE) UCL	10941		

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6498	95% Jackknife UCL	6586
95% Standard Bootstrap UCL	6422	95% Bootstrap-t UCL	6761
95% Hall's Bootstrap UCL	6867	95% Percentile Bootstrap UCL	6450
95% BCA Bootstrap UCL	6511		
90% Chebyshev(Mean, Sd) UCL	7207	95% Chebyshev(Mean, Sd) UCL	7917
97.5% Chebyshev(Mean, Sd) UCL	8904	99% Chebyshev(Mean, Sd) UCL	10841

Suggested UCL to Use

95% Student's-t UCL	6586

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	4
Minimum	4.1	Mean	9.295
Maximum	16	Median	7.6
SD	4.13	Std. Error of Mean	1.245
Coefficient of Variation	0.444	Skewness	0.349

Normal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.205	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	11.55	95% Adjusted-CLT UCL (Chen-1995)	11.48
		95% Modified-t UCL (Johnson-1978)	11.57

Gamma GOF Test

A-D Test Statistic	0.351	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.164	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.316	k star (bias corrected MLE)	3.927
Theta hat (MLE)	1.749	Theta star (bias corrected MLE)	2.367
nu hat (MLE)	117	nu star (bias corrected)	86.39
MLE Mean (bias corrected)	9.295	MLE Sd (bias corrected)	4.691
		Approximate Chi Square Value (0.05)	65.96
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	63.06

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	12.17	95% Adjusted Gamma UCL (use when n<50)	12.73

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.167	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.411	Mean of logged Data	2.133
Maximum of Logged Data	2.773	SD of logged Data	0.473

Assuming Lognormal Distribution

95% H-UCL	13	90% Chebyshev (MVUE) UCL	13.4
95% Chebyshev (MVUE) UCL	15.25	97.5% Chebyshev (MVUE) UCL	17.81
99% Chebyshev (MVUE) UCL	22.84		

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	11.34	95% Jackknife UCL	11.55
95% Standard Bootstrap UCL	11.25	95% Bootstrap-t UCL	11.82
95% Hall's Bootstrap UCL	11.32	95% Percentile Bootstrap UCL	11.25
95% BCA Bootstrap UCL	11.39		
90% Chebyshev(Mean, Sd) UCL	13.03	95% Chebyshev(Mean, Sd) UCL	14.72
97.5% Chebyshev(Mean, Sd) UCL	17.07	99% Chebyshev(Mean, Sd) UCL	21.69

Suggested UCL to Use

95% Student's-t UCL	11.55

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	11	Number of Distinct Observations	9
		Number of Missing Observations	4
Number of Detects	5	Number of Non-Detects	6
Number of Distinct Detects	5	Number of Distinct Non-Detects	4
Minimum Detect	0.42	Minimum Non-Detect	0.26
Maximum Detect	1.9	Maximum Non-Detect	1.4
Variance Detects	0.389	Percent Non-Detects	54.55%
Mean Detects	1.224	SD Detects	0.624
Median Detects	1.1	CV Detects	0.509
Skewness Detects	-0.0956	Kurtosis Detects	-1.817
Mean of Logged Detects	0.0704	SD of Logged Detects	0.613

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.741	KM Standard Error of Mean	0.21
KM SD	0.602	95% KM (BCA) UCL	1.036
95% KM (t) UCL	1.121	95% KM (Percentile Bootstrap) UCL	1.075
95% KM (z) UCL	1.086	95% KM Bootstrap t UCL	1.02
90% KM Chebyshev UCL	1.37	95% KM Chebyshev UCL	1.656
97.5% KM Chebyshev UCL	2.051	99% KM Chebyshev UCL	2.829

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.303	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.681	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.955	k star (bias corrected MLE)	1.715
Theta hat (MLE)	0.309	Theta star (bias corrected MLE)	0.714
nu hat (MLE)	39.55	nu star (bias corrected)	17.15
Mean (detects)	1.224		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.633
Maximum	1.9	Median	0.42
SD	0.708	CV	1.12
k hat (MLE)	0.515	k star (bias corrected MLE)	0.435
Theta hat (MLE)	1.227	Theta star (bias corrected MLE)	1.453
nu hat (MLE)	11.34	nu star (bias corrected)	9.579
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (9.58, α)	3.681	Adjusted Chi Square Value (9.58, β)	3.108
95% Gamma Approximate UCL (use when n>=50)	1.646	95% Gamma Adjusted UCL (use when n<50)	1.95

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.741	SD (KM)	0.602
Variance (KM)	0.362	SE of Mean (KM)	0.21
k hat (KM)	1.515	k star (KM)	1.162
nu hat (KM)	33.32	nu star (KM)	25.57
theta hat (KM)	0.489	theta star (KM)	0.637
80% gamma percentile (KM)	1.177	90% gamma percentile (KM)	1.644
95% gamma percentile (KM)	2.105	99% gamma percentile (KM)	3.166

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.57, α)	15.05	Adjusted Chi Square Value (25.57, β)	13.75
95% Gamma Approximate KM-UCL (use when n>=50)	1.259	95% Gamma Adjusted KM-UCL (use when n<50)	1.378

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.726	Mean in Log Scale	-0.639
SD in Original Scale	0.626	SD in Log Scale	0.824
95% t UCL (assumes normality of ROS data)	1.068	95% Percentile Bootstrap UCL	1.044
95% BCA Bootstrap UCL	1.066	95% Bootstrap t UCL	1.259
95% H-UCL (Log ROS)	1.488		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.621	KM Geo Mean	0.538
KM SD (logged)	0.789	95% Critical H Value (KM-Log)	2.613
KM Standard Error of Mean (logged)	0.283	95% H-UCL (KM -Log)	1.409
KM SD (logged)	0.789	95% Critical H Value (KM-Log)	2.613
KM Standard Error of Mean (logged)	0.283		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.732	Mean in Log Scale	-0.766
SD in Original Scale	0.648	SD in Log Scale	1.077
95% t UCL (Assumes normality)	1.086	95% H-Stat UCL	2.425

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.121

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	11	Number of Distinct Observations	9
		Number of Missing Observations	4
Minimum	3.5	Mean	5.45
Maximum	9.8	Median	4.7
SD	2.084	Std. Error of Mean	0.628
Coefficient of Variation	0.382	Skewness	1.194

Normal GOF Test

Shapiro Wilk Test Statistic	0.85	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.589	95% Adjusted-CLT UCL (Chen-1995)	6.725
		95% Modified-t UCL (Johnson-1978)	6.626

Gamma GOF Test

A-D Test Statistic	0.553	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.259	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.73	k star (bias corrected MLE)	6.409
Theta hat (MLE)	0.624	Theta star (bias corrected MLE)	0.85
nu hat (MLE)	192.1	nu star (bias corrected)	141
MLE Mean (bias corrected)	5.45	MLE Sd (bias corrected)	2.153
		Approximate Chi Square Value (0.05)	114.6
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	110.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.708	95% Adjusted Gamma UCL (use when n<50)	6.943

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.253	Mean of logged Data	1.637
Maximum of Logged Data	2.282	SD of logged Data	0.347

Assuming Lognormal Distribution

95% H-UCL	6.801	90% Chebyshev (MVUE) UCL	7.155
95% Chebyshev (MVUE) UCL	7.936	97.5% Chebyshev (MVUE) UCL	9.02
99% Chebyshev (MVUE) UCL	11.15		

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.483	95% Jackknife UCL	6.589
95% Standard Bootstrap UCL	6.429	95% Bootstrap-t UCL	7.23
95% Hall's Bootstrap UCL	7.067	95% Percentile Bootstrap UCL	6.477
95% BCA Bootstrap UCL	6.745		
90% Chebyshev(Mean, Sd) UCL	7.335	95% Chebyshev(Mean, Sd) UCL	8.188
97.5% Chebyshev(Mean, Sd) UCL	9.373	99% Chebyshev(Mean, Sd) UCL	11.7

Suggested UCL to Use

95% Student's-t UCL	6.589

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	4
Minimum	12	Mean	789.5
Maximum	4700	Median	37
SD	1701	Std. Error of Mean	512.9
Coefficient of Variation	2.155	Skewness	2

Normal GOF Test

Shapiro Wilk Test Statistic	0.516	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.483	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1719	95% Adjusted-CLT UCL (Chen-1995)	1964
		95% Modified-t UCL (Johnson-1978)	1771

Gamma GOF Test

A-D Test Statistic	2.15	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.827	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.435	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.277	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.284	k star (bias corrected MLE)	0.267
Theta hat (MLE)	2777	Theta star (bias corrected MLE)	2953
nu hat (MLE)	6.254	nu star (bias corrected)	5.882
MLE Mean (bias corrected)	789.5	MLE Sd (bias corrected)	1527
		Approximate Chi Square Value (0.05)	1.58
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	1.246

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2939	95% Adjusted Gamma UCL (use when n<50)	3727

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.706	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.323	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.485	Mean of logged Data	4.224
Maximum of Logged Data	8.455	SD of logged Data	2.095

Assuming Lognormal Distribution

95% H-UCL	21512	90% Chebyshev (MVUE) UCL	1174
95% Chebyshev (MVUE) UCL	1527	97.5% Chebyshev (MVUE) UCL	2018
99% Chebyshev (MVUE) UCL	2982		

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	1633	95% Jackknife UCL	1719
95% Standard Bootstrap UCL	1579	95% Bootstrap-t UCL	81118
95% Hall's Bootstrap UCL	44598	95% Percentile Bootstrap UCL	1635
95% BCA Bootstrap UCL	1886		
90% Chebyshev(Mean, Sd) UCL	2328	95% Chebyshev(Mean, Sd) UCL	3025
97.5% Chebyshev(Mean, Sd) UCL	3992	99% Chebyshev(Mean, Sd) UCL	5893

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	5893

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	3	Number of Non-Detects	7
Number of Distinct Detects	3	Number of Distinct Non-Detects	7
Minimum Detect	0.23	Minimum Non-Detect	0.088
Maximum Detect	7.1	Maximum Non-Detect	0.52
Variance Detects	15.05	Percent Non-Detects	70%
Mean Detects	2.623	SD Detects	3.88
Median Detects	0.54	CV Detects	1.479
Skewness Detects	1.72	Kurtosis Detects	N/A
Mean of Logged Detects	-0.0419	SD of Logged Detects	1.786

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.784	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.853	KM Standard Error of Mean	0.808
KM SD	2.087	95% KM (BCA) UCL	N/A
95% KM (t) UCL	2.335	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	2.183	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	3.278	95% KM Chebyshev UCL	4.376
97.5% KM Chebyshev UCL	5.901	99% KM Chebyshev UCL	8.895

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.612	k star (bias corrected MLE)	N/A
Theta hat (MLE)	4.285	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.673	nu star (bias corrected)	N/A
Mean (detects)	2.623		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.794
Maximum	7.1	Median	0.01
SD	2.222	CV	2.799
k hat (MLE)	0.238	k star (bias corrected MLE)	0.233
Theta hat (MLE)	3.334	Theta star (bias corrected MLE)	3.402
nu hat (MLE)	4.764	nu star (bias corrected)	4.668
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (4.67, α)	1.002	Adjusted Chi Square Value (4.67, β)	0.743
95% Gamma Approximate UCL (use when n>=50)	3.699	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.853	SD (KM)	2.087
Variance (KM)	4.354	SE of Mean (KM)	0.808
k hat (KM)	0.167	k star (KM)	0.184
nu hat (KM)	3.345	nu star (KM)	3.675
theta hat (KM)	5.103	theta star (KM)	4.644
80% gamma percentile (KM)	1.072	90% gamma percentile (KM)	2.576
95% gamma percentile (KM)	4.492	99% gamma percentile (KM)	9.843

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.67, α)	0.598	Adjusted Chi Square Value (3.67, β)	0.422
95% Gamma Approximate KM-UCL (use when n>=50)	5.248	95% Gamma Adjusted KM-UCL (use when n<50)	7.429

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.293	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.79	Mean in Log Scale	-3.939
SD in Original Scale	2.224	SD in Log Scale	2.831
95% t UCL (assumes normality of ROS data)	2.079	95% Percentile Bootstrap UCL	2.155
95% BCA Bootstrap UCL	2.896	95% Bootstrap t UCL	24.51
95% H-UCL (Log ROS)	1197		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.682	KM Geo Mean	0.186
KM SD (logged)	1.349	95% Critical H Value (KM-Log)	3.86
KM Standard Error of Mean (logged)	0.527	95% H-UCL (KM -Log)	2.621
KM SD (logged)	1.349	95% Critical H Value (KM-Log)	3.86
KM Standard Error of Mean (logged)	0.527		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.885	Mean in Log Scale	-1.501
SD in Original Scale	2.189	SD in Log Scale	1.405
95% t UCL (Assumes normality)	2.153	95% H-Stat UCL	3.869

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.335

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	4
Minimum	6900	Mean	17495
Maximum	59000	Median	13000
SD	14566	Std. Error of Mean	4392
Coefficient of Variation	0.833	Skewness	2.721

Normal GOF Test

Shapiro Wilk Test Statistic	0.642	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.332	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	25455	95% Adjusted-CLT UCL (Chen-1995)	28568
		95% Modified-t UCL (Johnson-1978)	26055

Gamma GOF Test

A-D Test Statistic	0.814	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.735	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.257	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.257	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.76	k star (bias corrected MLE)	2.068
Theta hat (MLE)	6339	Theta star (bias corrected MLE)	8461
nu hat (MLE)	60.71	nu star (bias corrected)	45.49
MLE Mean (bias corrected)	17495	MLE Sd (bias corrected)	12166
		Approximate Chi Square Value (0.05)	31.02
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	29.08

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	25658	95% Adjusted Gamma UCL (use when n<50)	27367

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.208	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.839	Mean of logged Data	9.578
Maximum of Logged Data	10.99	SD of logged Data	0.585

Assuming Lognormal Distribution

95% H-UCL	26191	90% Chebyshev (MVUE) UCL	25996
95% Chebyshev (MVUE) UCL	30145	97.5% Chebyshev (MVUE) UCL	35903
99% Chebyshev (MVUE) UCL	47213		

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	24719	95% Jackknife UCL	25455
95% Standard Bootstrap UCL	24594	95% Bootstrap-t UCL	41870
95% Hall's Bootstrap UCL	57350	95% Percentile Bootstrap UCL	25627
95% BCA Bootstrap UCL	28022		
90% Chebyshev(Mean, Sd) UCL	30670	95% Chebyshev(Mean, Sd) UCL	36639
97.5% Chebyshev(Mean, Sd) UCL	44922	99% Chebyshev(Mean, Sd) UCL	61194

Suggested UCL to Use

95% Adjusted Gamma UCL	27367

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	4
Minimum	12.5	Mean	151.9
Maximum	680	Median	58
SD	198.6	Std. Error of Mean	59.88
Coefficient of Variation	1.308	Skewness	2.198

Normal GOF Test

Shapiro Wilk Test Statistic	0.719	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	260.4	95% Adjusted-CLT UCL (Chen-1995)	292.8
		95% Modified-t UCL (Johnson-1978)	267

Gamma GOF Test

A-D Test Statistic	0.406	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.758	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.264	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.86	k star (bias corrected MLE)	0.686
Theta hat (MLE)	176.7	Theta star (bias corrected MLE)	221.4
nu hat (MLE)	18.91	nu star (bias corrected)	15.09
MLE Mean (bias corrected)	151.9	MLE Sd (bias corrected)	183.4
		Approximate Chi Square Value (0.05)	7.323
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	6.46

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	312.9	95% Adjusted Gamma UCL (use when n<50)	354.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.141	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.526	Mean of logged Data	4.339
Maximum of Logged Data	6.522	SD of logged Data	1.237

Assuming Lognormal Distribution

95% H-UCL	640.6	90% Chebyshev (MVUE) UCL	326
95% Chebyshev (MVUE) UCL	406.6	97.5% Chebyshev (MVUE) UCL	518.3
99% Chebyshev (MVUE) UCL	737.9		

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	250.4	95% Jackknife UCL	260.4
95% Standard Bootstrap UCL	247.3	95% Bootstrap-t UCL	394.5
95% Hall's Bootstrap UCL	643.9	95% Percentile Bootstrap UCL	256.1
95% BCA Bootstrap UCL	286.3		
90% Chebyshev(Mean, Sd) UCL	331.5	95% Chebyshev(Mean, Sd) UCL	412.9
97.5% Chebyshev(Mean, Sd) UCL	525.8	99% Chebyshev(Mean, Sd) UCL	747.7

Suggested UCL to Use

95% Student's-t UCL	260.4

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	4
Minimum	230	Mean	413.5
Maximum	810	Median	360
SD	198.8	Std. Error of Mean	59.93
Coefficient of Variation	0.481	Skewness	1.062

Normal GOF Test

Shapiro Wilk Test Statistic	0.858	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	522.1	95% Adjusted-CLT UCL (Chen-1995)	532.5
		95% Modified-t UCL (Johnson-1978)	525.3

Gamma GOF Test

A-D Test Statistic	0.484	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.45	k star (bias corrected MLE)	4.024
Theta hat (MLE)	75.86	Theta star (bias corrected MLE)	102.7
nu hat (MLE)	119.9	nu star (bias corrected)	88.53
MLE Mean (bias corrected)	413.5	MLE Sd (bias corrected)	206.1
		Approximate Chi Square Value (0.05)	67.84
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	64.89

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	539.6	95% Adjusted Gamma UCL (use when n<50)	564.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.438	Mean of logged Data	5.93
Maximum of Logged Data	6.697	SD of logged Data	0.445

Assuming Lognormal Distribution

95% H-UCL	558.5	90% Chebyshev (MVUE) UCL	579.6
95% Chebyshev (MVUE) UCL	655.8	97.5% Chebyshev (MVUE) UCL	761.6
99% Chebyshev (MVUE) UCL	969.5		

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	512	95% Jackknife UCL	522.1
95% Standard Bootstrap UCL	505.9	95% Bootstrap-t UCL	564.2
95% Hall's Bootstrap UCL	539.1	95% Percentile Bootstrap UCL	507.3
95% BCA Bootstrap UCL	526.5		
90% Chebyshev(Mean, Sd) UCL	593.2	95% Chebyshev(Mean, Sd) UCL	674.7
97.5% Chebyshev(Mean, Sd) UCL	787.7	99% Chebyshev(Mean, Sd) UCL	1010

Suggested UCL to Use

95% Student's-t UCL	522.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	4
Number of Detects	10	Number of Non-Detects	1
Number of Distinct Detects	10	Number of Distinct Non-Detects	1
Minimum Detect	0.1	Minimum Non-Detect	0.1
Maximum Detect	0.53	Maximum Non-Detect	0.1
Variance Detects	0.0167	Percent Non-Detects	9.091%
Mean Detects	0.241	SD Detects	0.129
Median Detects	0.2	CV Detects	0.538
Skewness Detects	1.295	Kurtosis Detects	1.754
Mean of Logged Detects	-1.544	SD of Logged Detects	0.507

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.228	KM Standard Error of Mean	0.0394
KM SD	0.124	95% KM (BCA) UCL	0.295
95% KM (t) UCL	0.299	95% KM (Percentile Bootstrap) UCL	0.291
95% KM (z) UCL	0.292	95% KM Bootstrap t UCL	0.33
90% KM Chebyshev UCL	0.346	95% KM Chebyshev UCL	0.399
97.5% KM Chebyshev UCL	0.474	99% KM Chebyshev UCL	0.619

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.216	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.146	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.378	k star (bias corrected MLE)	3.131
Theta hat (MLE)	0.0549	Theta star (bias corrected MLE)	0.0768
nu hat (MLE)	87.56	nu star (bias corrected)	62.62
Mean (detects)	0.241		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.22
Maximum	0.53	Median	0.19
SD	0.141	CV	0.643
k hat (MLE)	1.784	k star (bias corrected MLE)	1.358
Theta hat (MLE)	0.123	Theta star (bias corrected MLE)	0.162
nu hat (MLE)	39.25	nu star (bias corrected)	29.88
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (29.88, α)	18.4	Adjusted Chi Square Value (29.88, β)	16.94
95% Gamma Approximate UCL (use when n>=50)	0.357	95% Gamma Adjusted UCL (use when n<50)	0.387

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.228	SD (KM)	0.124
Variance (KM)	0.0153	SE of Mean (KM)	0.0394
k hat (KM)	3.382	k star (KM)	2.52
nu hat (KM)	74.41	nu star (KM)	55.45
theta hat (KM)	0.0673	theta star (KM)	0.0904
80% gamma percentile (KM)	0.332	90% gamma percentile (KM)	0.42
95% gamma percentile (KM)	0.503	99% gamma percentile (KM)	0.685

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (55.45, α)	39.34	Adjusted Chi Square Value (55.45, β)	37.13
95% Gamma Approximate KM-UCL (use when n>=50)	0.321	95% Gamma Adjusted KM-UCL (use when n<50)	0.34

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.982	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.113	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.224	Mean in Log Scale	-1.658
SD in Original Scale	0.134	SD in Log Scale	0.613
95% t UCL (assumes normality of ROS data)	0.297	95% Percentile Bootstrap UCL	0.288
95% BCA Bootstrap UCL	0.301	95% Bootstrap t UCL	0.329
95% H-UCL (Log ROS)	0.361		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.613	KM Geo Mean	0.199
KM SD (logged)	0.508	95% Critical H Value (KM-Log)	2.186
KM Standard Error of Mean (logged)	0.161	95% H-UCL (KM -Log)	0.322
KM SD (logged)	0.508	95% Critical H Value (KM-Log)	2.186
KM Standard Error of Mean (logged)	0.161		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.223	Mean in Log Scale	-1.676
SD in Original Scale	0.136	SD in Log Scale	0.651
95% t UCL (Assumes normality)	0.297	95% H-Stat UCL	0.378

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.299

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	4
Minimum	12.3	Mean	22.26
Maximum	60	Median	17.5
SD	13.44	Std. Error of Mean	4.051
Coefficient of Variation	0.604	Skewness	2.604

Normal GOF Test

Shapiro Wilk Test Statistic	0.662	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.296	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	29.61	95% Adjusted-CLT UCL (Chen-1995)	32.33
		95% Modified-t UCL (Johnson-1978)	30.14

Gamma GOF Test

A-D Test Statistic	0.961	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.252	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.802	k star (bias corrected MLE)	3.553
Theta hat (MLE)	4.636	Theta star (bias corrected MLE)	6.266
nu hat (MLE)	105.6	nu star (bias corrected)	78.17
MLE Mean (bias corrected)	22.26	MLE Sd (bias corrected)	11.81
		Approximate Chi Square Value (0.05)	58.8
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	56.07

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	29.6	95% Adjusted Gamma UCL (use when n<50)	31.04

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.843	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.51	Mean of logged Data	2.995
Maximum of Logged Data	4.094	SD of logged Data	0.441

Assuming Lognormal Distribution

95% H-UCL	29.54	90% Chebyshev (MVUE) UCL	30.68
95% Chebyshev (MVUE) UCL	34.68	97.5% Chebyshev (MVUE) UCL	40.25
99% Chebyshev (MVUE) UCL	51.18		

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	28.93	95% Jackknife UCL	29.61
95% Standard Bootstrap UCL	28.75	95% Bootstrap-t UCL	44.79
95% Hall's Bootstrap UCL	58.76	95% Percentile Bootstrap UCL	29.35
95% BCA Bootstrap UCL	32.72		
90% Chebyshev(Mean, Sd) UCL	34.42	95% Chebyshev(Mean, Sd) UCL	39.92
97.5% Chebyshev(Mean, Sd) UCL	47.57	99% Chebyshev(Mean, Sd) UCL	62.58

Suggested UCL to Use

95% Adjusted Gamma UCL	31.04

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	4
Number of Detects	3	Number of Non-Detects	8
Number of Distinct Detects	3	Number of Distinct Non-Detects	8
Minimum Detect	41	Minimum Non-Detect	17
Maximum Detect	170	Maximum Non-Detect	260
Variance Detects	5187	Percent Non-Detects	72.73%
Mean Detects	87	SD Detects	72.02
Median Detects	50	CV Detects	0.828
Skewness Detects	1.702	Kurtosis Detects	N/A
Mean of Logged Detects	4.254	SD of Logged Detects	0.77

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.802	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.363	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	38	KM Standard Error of Mean	17.61
KM SD	45.46	95% KM (BCA) UCL	N/A
95% KM (t) UCL	69.91	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	66.96	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	90.82	95% KM Chebyshev UCL	114.7
97.5% KM Chebyshev UCL	147.9	99% KM Chebyshev UCL	213.2

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	2.511	k star (bias corrected MLE)	N/A
Theta hat (MLE)	34.64	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	15.07	nu star (bias corrected)	N/A
Mean (detects)	87		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	23.73
Maximum	170	Median	0.01
SD	51.85	CV	2.185
k hat (MLE)	0.144	k star (bias corrected MLE)	0.166
Theta hat (MLE)	164.5	Theta star (bias corrected MLE)	143.4
nu hat (MLE)	3.175	nu star (bias corrected)	3.642
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (3.64, α)	0.586	Adjusted Chi Square Value (3.64, β)	0.422
95% Gamma Approximate UCL (use when n>=50)	147.6	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.7.4

Summary of ProUCL Output for EU09 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:51:11 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	38	SD (KM)	45.46
Variance (KM)	2066	SE of Mean (KM)	17.61
k hat (KM)	0.699	k star (KM)	0.569
nu hat (KM)	15.37	nu star (KM)	12.51
theta hat (KM)	54.38	theta star (KM)	66.8
80% gamma percentile (KM)	62.62	90% gamma percentile (KM)	100
95% gamma percentile (KM)	139.4	99% gamma percentile (KM)	235.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.51, α)	5.568	Adjusted Chi Square Value (12.51, β)	4.833
95% Gamma Approximate KM-UCL (use when n>=50)	85.41	95% Gamma Adjusted KM-UCL (use when n<50)	98.39

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	26.31	Mean in Log Scale	2.047
SD in Original Scale	50.58	SD in Log Scale	1.479
95% t UCL (assumes normality of ROS data)	53.95	95% Percentile Bootstrap UCL	52.85
95% BCA Bootstrap UCL	71.48	95% Bootstrap t UCL	111.6
95% H-UCL (Log ROS)	149.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.259	KM Geo Mean	26.03
KM SD (logged)	0.737	95% Critical H Value (KM-Log)	2.525
KM Standard Error of Mean (logged)	0.285	95% H-UCL (KM -Log)	61.48
KM SD (logged)	0.737	95% Critical H Value (KM-Log)	2.525
KM Standard Error of Mean (logged)	0.285		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	44.2	Mean in Log Scale	3.246
SD in Original Scale	54.64	SD in Log Scale	1.017
95% t UCL (Assumes normality)	74.06	95% H-Stat UCL	114.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	69.91

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.1

Summary of ProUCL Input Data for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Aluminum	D_Aluminum	Arsenic	D_Arsenic
on-site (EU10)	SS-32	10/31/2018	0.25-2.25 ft BGS	210	1	340	1	42	1	31	1	2400	1	4	1
on-site (EU10)	SS-78	10/31/2018	0-2 ft BGS	180	1	270	1	33	1	34	1	9600	1	8.2	1
on-site (EU10)	SS-79	10/31/2018	0-2 ft BGS	270	1	520	1	23	0	88	1	12000	1	27	1
on-site (EU10)	SS-80	10/31/2018	0-2 ft BGS	150	1	250	1	21	0	41	1	4600	1	14	1
on-site (EU10)	SS-81	10/31/2018	0.33-2.33 ft BGS	170	1	310	1	44	1	26	1	6000	1	6.4	1
on-site (EU10)	SS-82	10/31/2018	0-2 ft BGS	28	1	61	1	21	0	11	1	3000	1	6.8	1
on-site (EU10)	SS-83	10/31/2018	0-2 ft BGS	840	1	1300	1	280	1	150	1	3800	1	6	1
on-site (EU10)	SS-84	10/31/2018	0-2 ft BGS	73	1	120	1	21	0	17	1	11000	1	8.6	1
on-site (EU10)	SS-85	10/31/2018	0.25-2.25 ft BGS												
on-site (EU10)	SS-163-AS	10/31/2018	0.33-0.83 ft BGS												
on-site (EU10)	SS-164-AS	10/31/2018	0.25-0.75 ft BGS												

Table B.8.1

Summary of ProUCL Input Data for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23	24	25
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Dieldrin	D_Dieldrin
on-site (EU10)	SS-32	10/31/2018	0.25-2.25 ft BGS	0.25	0	2.6	1	7400	1	370	1	0.1	1	23	0	1.1	0
on-site (EU10)	SS-78	10/31/2018	0-2 ft BGS	0.27	0	6.3	1	15000	1	490	1	0.25	1	41	1	3.3	1
on-site (EU10)	SS-79	10/31/2018	0-2 ft BGS	0.3	0	8.9	1	13000	1	220	1	0.27	1	28	0	13	0
on-site (EU10)	SS-80	10/31/2018	0-2 ft BGS	0.42	1	6.3	1	8800	1	240	1	0.38	1	24	0	6	0
on-site (EU10)	SS-81	10/31/2018	0.33-2.33 ft BGS	0.28	0	5.5	1	12000	1	210	1	0.19	1	550	1	37	1
on-site (EU10)	SS-82	10/31/2018	0-2 ft BGS	0.27	0	4.4	1	27000	1	550	1	0.1	1	25	0	1.2	0
on-site (EU10)	SS-83	10/31/2018	0-2 ft BGS	0.26	0	3.2	1	8100	1	250	1	0.13	1	40	1	1.2	0
on-site (EU10)	SS-84	10/31/2018	0-2 ft BGS	0.44	1	7.7	1	18000	1	350	1	0.28	1	760	1	6.1	0
on-site (EU10)	SS-85	10/31/2018	0.25-2.25 ft BGS														
on-site (EU10)	SS-163-AS	10/31/2018	0.33-0.83 ft BGS														
on-site (EU10)	SS-164-AS	10/31/2018	0.25-0.75 ft BGS														

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	28	Mean	240.1
Maximum	840	Median	175
SD	253.9	Std. Error of Mean	89.76
Coefficient of Variation	1.057	Skewness	2.332

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.328	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	410.2	95% Adjusted-CLT UCL (Chen-1995)	466.8
		95% Modified-t UCL (Johnson-1978)	422.5

Gamma GOF Test

A-D Test Statistic	0.416	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.211	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.39	k star (bias corrected MLE)	0.952
Theta hat (MLE)	172.8	Theta star (bias corrected MLE)	252.2
nu hat (MLE)	22.24	nu star (bias corrected)	15.23
MLE Mean (bias corrected)	240.1	MLE Sd (bias corrected)	246.1
		Approximate Chi Square Value (0.05)	7.423
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	6.098

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	492.7	95% Adjusted Gamma UCL (use when n<50)	599.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.332	Mean of logged Data	5.08
Maximum of Logged Data	6.733	SD of logged Data	0.984

Assuming Lognormal Distribution

95% H-UCL	918.4	90% Chebyshev (MVUE) UCL	498
95% Chebyshev (MVUE) UCL	614.4	97.5% Chebyshev (MVUE) UCL	775.8
99% Chebyshev (MVUE) UCL	1093		

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	387.8	95% Jackknife UCL	410.2
95% Standard Bootstrap UCL	381.9	95% Bootstrap-t UCL	661.6
95% Hall's Bootstrap UCL	1091	95% Percentile Bootstrap UCL	407.3
95% BCA Bootstrap UCL	442.5		
90% Chebyshev(Mean, Sd) UCL	509.4	95% Chebyshev(Mean, Sd) UCL	631.4
97.5% Chebyshev(Mean, Sd) UCL	800.7	99% Chebyshev(Mean, Sd) UCL	1133

Suggested UCL to Use

95% Adjusted Gamma UCL	599.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	61	Mean	396.4
Maximum	1300	Median	290
SD	390.7	Std. Error of Mean	138.1
Coefficient of Variation	0.986	Skewness	2.155

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.748	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	658.1	95% Adjusted-CLT UCL (Chen-1995)	736.1
		95% Modified-t UCL (Johnson-1978)	675.6

Gamma GOF Test

A-D Test Statistic	0.343	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.215	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.549	k star (bias corrected MLE)	1.051
Theta hat (MLE)	256	Theta star (bias corrected MLE)	377.1
nu hat (MLE)	24.78	nu star (bias corrected)	16.82
MLE Mean (bias corrected)	396.4	MLE Sd (bias corrected)	386.6
		Approximate Chi Square Value (0.05)	8.543
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	7.103

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	780.4	95% Adjusted Gamma UCL (use when n<50)	938.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.204	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.111	Mean of logged Data	5.626
Maximum of Logged Data	7.17	SD of logged Data	0.914

Assuming Lognormal Distribution

95% H-UCL	1279	90% Chebyshev (MVUE) UCL	784.5
95% Chebyshev (MVUE) UCL	961.2	97.5% Chebyshev (MVUE) UCL	1206
99% Chebyshev (MVUE) UCL	1688		

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	623.6	95% Jackknife UCL	658.1
95% Standard Bootstrap UCL	604.3	95% Bootstrap-t UCL	1077
95% Hall's Bootstrap UCL	1768	95% Percentile Bootstrap UCL	637.8
95% BCA Bootstrap UCL	766.4		
90% Chebyshev(Mean, Sd) UCL	810.8	95% Chebyshev(Mean, Sd) UCL	998.5
97.5% Chebyshev(Mean, Sd) UCL	1259	99% Chebyshev(Mean, Sd) UCL	1771

Suggested UCL to Use

95% Adjusted Gamma UCL	938.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	8	Number of Distinct Observations	6
Number of Detects	4	Number of Non-Detects	4
Number of Distinct Detects	4	Number of Distinct Non-Detects	2
Minimum Detect	33	Minimum Non-Detect	21
Maximum Detect	280	Maximum Non-Detect	23
Variance Detects	14463	Percent Non-Detects	50%
Mean Detects	99.75	SD Detects	120.3
Median Detects	43	CV Detects	1.206
Skewness Detects	1.99	Kurtosis Detects	3.969
Mean of Logged Detects	4.163	SD of Logged Detects	0.989

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.667	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.429	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	60.38	KM Standard Error of Mean	34.09
KM SD	83.51	95% KM (BCA) UCL	N/A
95% KM (t) UCL	125	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	116.5	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	162.7	95% KM Chebyshev UCL	209
97.5% KM Chebyshev UCL	273.3	99% KM Chebyshev UCL	399.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.776	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.664	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.442	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.401	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.279	k star (bias corrected MLE)	0.486
Theta hat (MLE)	77.99	Theta star (bias corrected MLE)	205.1
nu hat (MLE)	10.23	nu star (bias corrected)	3.891
Mean (detects)	99.75		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	49.88
Maximum	280	Median	16.51
SD	95.08	CV	1.906
k hat (MLE)	0.181	k star (bias corrected MLE)	0.196
Theta hat (MLE)	275.7	Theta star (bias corrected MLE)	253.9
nu hat (MLE)	2.895	nu star (bias corrected)	3.143
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (3.14, α)	0.416	Adjusted Chi Square Value (3.14, β)	0.24
95% Gamma Approximate UCL (use when n>=50)	376.9	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	60.38	SD (KM)	83.51
Variance (KM)	6974	SE of Mean (KM)	34.09
k hat (KM)	0.523	k star (KM)	0.41
nu hat (KM)	8.363	nu star (KM)	6.56
theta hat (KM)	115.5	theta star (KM)	147.3
80% gamma percentile (KM)	97.71	90% gamma percentile (KM)	169.8
95% gamma percentile (KM)	248.7	99% gamma percentile (KM)	446.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.56, α)	1.932	Adjusted Chi Square Value (6.56, β)	1.364
95% Gamma Approximate KM-UCL (use when n>=50)	205	95% Gamma Adjusted KM-UCL (use when n<50)	290.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.744	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.399	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	52.03	Mean in Log Scale	2.73
SD in Original Scale	93.83	SD in Log Scale	1.722
95% t UCL (assumes normality of ROS data)	114.9	95% Percentile Bootstrap UCL	114.7
95% BCA Bootstrap UCL	145.6	95% Bootstrap t UCL	283.6
95% H-UCL (Log ROS)	2206		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.604	KM Geo Mean	36.74
KM SD (logged)	0.824	95% Critical H Value (KM-Log)	3.007
KM Standard Error of Mean (logged)	0.337	95% H-UCL (KM -Log)	131.8
KM SD (logged)	0.824	95% Critical H Value (KM-Log)	3.007
KM Standard Error of Mean (logged)	0.337		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	55.25	Mean in Log Scale	3.269
SD in Original Scale	91.99	SD in Log Scale	1.155
95% t UCL (Assumes normality)	116.9	95% H-Stat UCL	271.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	209

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	11	Mean	49.75
Maximum	150	Median	32.5
SD	46.79	Std. Error of Mean	16.54
Coefficient of Variation	0.941	Skewness	1.758

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.78	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.324	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	81.09	95% Adjusted-CLT UCL (Chen-1995)	87.95
		95% Modified-t UCL (Johnson-1978)	82.81

Gamma GOF Test

A-D Test Statistic	0.394	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.242	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.298	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.683	k star (bias corrected MLE)	1.135
Theta hat (MLE)	29.56	Theta star (bias corrected MLE)	43.83
nu hat (MLE)	26.93	nu star (bias corrected)	18.16
MLE Mean (bias corrected)	49.75	MLE Sd (bias corrected)	46.69
		Approximate Chi Square Value (0.05)	9.508
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	7.975

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	95.03	95% Adjusted Gamma UCL (use when n<50)	113.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.398	Mean of logged Data	3.581
Maximum of Logged Data	5.011	SD of logged Data	0.841

Assuming Lognormal Distribution

95% H-UCL	134.7	90% Chebyshev (MVUE) UCL	92.56
95% Chebyshev (MVUE) UCL	112.5	97.5% Chebyshev (MVUE) UCL	140.3
99% Chebyshev (MVUE) UCL	194.7		

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	76.96	95% Jackknife UCL	81.09
95% Standard Bootstrap UCL	75.98	95% Bootstrap-t UCL	151
95% Hall's Bootstrap UCL	252.9	95% Percentile Bootstrap UCL	76.63
95% BCA Bootstrap UCL	87.38		
90% Chebyshev(Mean, Sd) UCL	99.38	95% Chebyshev(Mean, Sd) UCL	121.9
97.5% Chebyshev(Mean, Sd) UCL	153.1	99% Chebyshev(Mean, Sd) UCL	214.4

Suggested UCL to Use

95% Adjusted Gamma UCL	113.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	2400	Mean	6550
Maximum	12000	Median	5300
SD	3785	Std. Error of Mean	1338
Coefficient of Variation	0.578	Skewness	0.47

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9086	95% Adjusted-CLT UCL (Chen-1995)	8989
		95% Modified-t UCL (Johnson-1978)	9123

Gamma GOF Test

A-D Test Statistic	0.354	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.197	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.321	k star (bias corrected MLE)	2.159
Theta hat (MLE)	1972	Theta star (bias corrected MLE)	3034
nu hat (MLE)	53.14	nu star (bias corrected)	34.55
MLE Mean (bias corrected)	6550	MLE Sd (bias corrected)	4458
		Approximate Chi Square Value (0.05)	22.1
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	19.62

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	10238	95% Adjusted Gamma UCL (use when n<50)	11532

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.186	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.783	Mean of logged Data	8.629
Maximum of Logged Data	9.393	SD of logged Data	0.613

Assuming Lognormal Distribution

95% H-UCL	12204	90% Chebyshev (MVUE) UCL	10902
95% Chebyshev (MVUE) UCL	12863	97.5% Chebyshev (MVUE) UCL	15585
99% Chebyshev (MVUE) UCL	20932		

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8751	95% Jackknife UCL	9086
95% Standard Bootstrap UCL	8622	95% Bootstrap-t UCL	9299
95% Hall's Bootstrap UCL	8285	95% Percentile Bootstrap UCL	8675
95% BCA Bootstrap UCL	8825		
90% Chebyshev(Mean, Sd) UCL	10565	95% Chebyshev(Mean, Sd) UCL	12384
97.5% Chebyshev(Mean, Sd) UCL	14908	99% Chebyshev(Mean, Sd) UCL	19866

Suggested UCL to Use

95% Student's-t UCL	9086

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	4	Mean	10.13
Maximum	27	Median	7.5
SD	7.419	Std. Error of Mean	2.623
Coefficient of Variation	0.733	Skewness	2.083

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.742	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.331	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15.09	95% Adjusted-CLT UCL (Chen-1995)	16.5
		95% Modified-t UCL (Johnson-1978)	15.42

Gamma GOF Test

A-D Test Statistic	0.576	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.283	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.059	k star (bias corrected MLE)	1.995
Theta hat (MLE)	3.31	Theta star (bias corrected MLE)	5.074
nu hat (MLE)	48.95	nu star (bias corrected)	31.93
MLE Mean (bias corrected)	10.13	MLE Sd (bias corrected)	7.168
		Approximate Chi Square Value (0.05)	20.01
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	17.67

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	16.15	95% Adjusted Gamma UCL (use when n<50)	18.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.386	Mean of logged Data	2.143
Maximum of Logged Data	3.296	SD of logged Data	0.586

Assuming Lognormal Distribution

95% H-UCL	17.64	90% Chebyshev (MVUE) UCL	16.11
95% Chebyshev (MVUE) UCL	18.92	97.5% Chebyshev (MVUE) UCL	22.84
99% Chebyshev (MVUE) UCL	30.52		

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	14.44	95% Jackknife UCL	15.09
95% Standard Bootstrap UCL	14.2	95% Bootstrap-t UCL	27.41
95% Hall's Bootstrap UCL	39.32	95% Percentile Bootstrap UCL	14.73
95% BCA Bootstrap UCL	16		
90% Chebyshev(Mean, Sd) UCL	17.99	95% Chebyshev(Mean, Sd) UCL	21.56
97.5% Chebyshev(Mean, Sd) UCL	26.51	99% Chebyshev(Mean, Sd) UCL	36.22

Suggested UCL to Use

95% Adjusted Gamma UCL	18.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
Number of Detects	2	Number of Non-Detects	6
Number of Distinct Detects	2	Number of Distinct Non-Detects	5
Minimum Detect	0.42	Minimum Non-Detect	0.25
Maximum Detect	0.44	Maximum Non-Detect	0.3
Variance Detects	2.0000E-4	Percent Non-Detects	75%
Mean Detects	0.43	SD Detects	0.0141
Median Detects	0.43	CV Detects	0.0329
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-0.844	SD of Logged Detects	0.0329

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.295	KM Standard Error of Mean	0.0391
KM SD	0.0781	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.369	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.359	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.412	95% KM Chebyshev UCL	0.465
97.5% KM Chebyshev UCL	0.539	99% KM Chebyshev UCL	0.684

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1849	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2.3260E-4	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	7395	nu star (bias corrected)	N/A
Mean (detects)	0.43		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.295	SD (KM)	0.0781
Variance (KM)	0.0061	SE of Mean (KM)	0.0391
k hat (KM)	14.27	k star (KM)	9
nu hat (KM)	228.3	nu star (KM)	144
theta hat (KM)	0.0207	theta star (KM)	0.0328
80% gamma percentile (KM)	0.373	90% gamma percentile (KM)	0.426
95% gamma percentile (KM)	0.473	99% gamma percentile (KM)	0.57

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0195
Approximate Chi Square Value (144.00, α)	117.3	Adjusted Chi Square Value (144.00, β)	111.2
95% Gamma Approximate KM-UCL (use when n>=50)	0.362	95% Gamma Adjusted KM-UCL (use when n<50)	0.382

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.38	Mean in Log Scale	-0.97
SD in Original Scale	0.0321	SD in Log Scale	0.0813
95% t UCL (assumes normality of ROS data)	0.402	95% Percentile Bootstrap UCL	0.398
95% BCA Bootstrap UCL	0.401	95% Bootstrap t UCL	0.447
95% H-UCL (Log ROS)	N/A		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.251	KM Geo Mean	0.286
KM SD (logged)	0.235	95% Critical H Value (KM-Log)	1.981
KM Standard Error of Mean (logged)	0.118	95% H-UCL (KM -Log)	0.351
KM SD (logged)	0.235	95% Critical H Value (KM-Log)	1.981
KM Standard Error of Mean (logged)	0.118		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.209	Mean in Log Scale	-1.71
SD in Original Scale	0.136	SD in Log Scale	0.537
95% t UCL (Assumes normality)	0.301	95% H-Stat UCL	0.341

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.369	KM H-UCL	0.351
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	2.6	Mean	5.613
Maximum	8.9	Median	5.9
SD	2.154	Std. Error of Mean	0.762
Coefficient of Variation	0.384	Skewness	0.0402

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.125	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7.056	95% Adjusted-CLT UCL (Chen-1995)	6.877
		95% Modified-t UCL (Johnson-1978)	7.057

Gamma GOF Test

A-D Test Statistic	0.24	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.169	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.982	k star (bias corrected MLE)	4.447
Theta hat (MLE)	0.804	Theta star (bias corrected MLE)	1.262
nu hat (MLE)	111.7	nu star (bias corrected)	71.15
MLE Mean (bias corrected)	5.613	MLE Sd (bias corrected)	2.662
		Approximate Chi Square Value (0.05)	52.73
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	48.74

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7.573	95% Adjusted Gamma UCL (use when n<50)	8.193

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.956	Mean of logged Data	1.652
Maximum of Logged Data	2.186	SD of logged Data	0.425

Assuming Lognormal Distribution

95% H-UCL	8.17	90% Chebyshev (MVUE) UCL	8.202
95% Chebyshev (MVUE) UCL	9.362	97.5% Chebyshev (MVUE) UCL	10.97
99% Chebyshev (MVUE) UCL	14.14		

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.865	95% Jackknife UCL	7.056
95% Standard Bootstrap UCL	6.774	95% Bootstrap-t UCL	7.043
95% Hall's Bootstrap UCL	6.891	95% Percentile Bootstrap UCL	6.775
95% BCA Bootstrap UCL	6.813		
90% Chebyshev(Mean, Sd) UCL	7.898	95% Chebyshev(Mean, Sd) UCL	8.933
97.5% Chebyshev(Mean, Sd) UCL	10.37	99% Chebyshev(Mean, Sd) UCL	13.19

Suggested UCL to Use

95% Student's-t UCL	7.056

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	7400	Mean	13663
Maximum	27000	Median	12500
SD	6497	Std. Error of Mean	2297
Coefficient of Variation	0.476	Skewness	1.333

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	18015	95% Adjusted-CLT UCL (Chen-1995)	18597
		95% Modified-t UCL (Johnson-1978)	18195

Gamma GOF Test

A-D Test Statistic	0.272	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.177	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.835	k star (bias corrected MLE)	3.73
Theta hat (MLE)	2341	Theta star (bias corrected MLE)	3663
nu hat (MLE)	93.36	nu star (bias corrected)	59.68
MLE Mean (bias corrected)	13663	MLE Sd (bias corrected)	7074
		Approximate Chi Square Value (0.05)	42.92
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	39.35

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	18999	95% Adjusted Gamma UCL (use when n<50)	20723

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.909	Mean of logged Data	9.434
Maximum of Logged Data	10.2	SD of logged Data	0.439

Assuming Lognormal Distribution

95% H-UCL	20023	90% Chebyshev (MVUE) UCL	19982
95% Chebyshev (MVUE) UCL	22874	97.5% Chebyshev (MVUE) UCL	26887
99% Chebyshev (MVUE) UCL	34769		

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d0

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	17441	95% Jackknife UCL	18015
95% Standard Bootstrap UCL	17232	95% Bootstrap-t UCL	21055
95% Hall's Bootstrap UCL	35786	95% Percentile Bootstrap UCL	17225
95% BCA Bootstrap UCL	18150		
90% Chebyshev(Mean, Sd) UCL	20554	95% Chebyshev(Mean, Sd) UCL	23675
97.5% Chebyshev(Mean, Sd) UCL	28008	99% Chebyshev(Mean, Sd) UCL	36519

Suggested UCL to Use

95% Student's-t UCL	18015

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	210	Mean	335
Maximum	550	Median	300
SD	129.2	Std. Error of Mean	45.67
Coefficient of Variation	0.386	Skewness	0.774

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	421.5	95% Adjusted-CLT UCL (Chen-1995)	423.5
		95% Modified-t UCL (Johnson-1978)	423.6

Gamma GOF Test

A-D Test Statistic	0.451	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.253	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.253	k star (bias corrected MLE)	5.241
Theta hat (MLE)	40.59	Theta star (bias corrected MLE)	63.91
nu hat (MLE)	132	nu star (bias corrected)	83.86
MLE Mean (bias corrected)	335	MLE Sd (bias corrected)	146.3
		Approximate Chi Square Value (0.05)	63.76
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	59.34

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	440.6	95% Adjusted Gamma UCL (use when n<50)	473.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.347	Mean of logged Data	5.752
Maximum of Logged Data	6.31	SD of logged Data	0.371

Assuming Lognormal Distribution

95% H-UCL	456.2	90% Chebyshev (MVUE) UCL	466.7
95% Chebyshev (MVUE) UCL	526.6	97.5% Chebyshev (MVUE) UCL	609.8
99% Chebyshev (MVUE) UCL	773.3		

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	410.1	95% Jackknife UCL	421.5
95% Standard Bootstrap UCL	405.1	95% Bootstrap-t UCL	482.7
95% Hall's Bootstrap UCL	437.4	95% Percentile Bootstrap UCL	406.3
95% BCA Bootstrap UCL	415		
90% Chebyshev(Mean, Sd) UCL	472	95% Chebyshev(Mean, Sd) UCL	534.1
97.5% Chebyshev(Mean, Sd) UCL	620.2	99% Chebyshev(Mean, Sd) UCL	789.4

Suggested UCL to Use

95% Student's-t UCL	421.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.1	Mean	0.213
Maximum	0.38	Median	0.22
SD	0.1	Std. Error of Mean	0.0353
Coefficient of Variation	0.47	Skewness	0.349

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.279	95% Adjusted-CLT UCL (Chen-1995)	0.275
		95% Modified-t UCL (Johnson-1978)	0.28

Gamma GOF Test

A-D Test Statistic	0.372	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.198	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.856	k star (bias corrected MLE)	3.119
Theta hat (MLE)	0.0438	Theta star (bias corrected MLE)	0.0681
nu hat (MLE)	77.7	nu star (bias corrected)	49.9
MLE Mean (bias corrected)	0.213	MLE Sd (bias corrected)	0.12
		Approximate Chi Square Value (0.05)	34.68
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	31.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.306	95% Adjusted Gamma UCL (use when n<50)	0.337

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.303	Mean of logged Data	-1.655
Maximum of Logged Data	-0.968	SD of logged Data	0.507

Assuming Lognormal Distribution

95% H-UCL	0.342	90% Chebyshev (MVUE) UCL	0.329
95% Chebyshev (MVUE) UCL	0.382	97.5% Chebyshev (MVUE) UCL	0.455
99% Chebyshev (MVUE) UCL	0.598		

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.271	95% Jackknife UCL	0.279
95% Standard Bootstrap UCL	0.268	95% Bootstrap-t UCL	0.286
95% Hall's Bootstrap UCL	0.271	95% Percentile Bootstrap UCL	0.268
95% BCA Bootstrap UCL	0.268		
90% Chebyshev(Mean, Sd) UCL	0.319	95% Chebyshev(Mean, Sd) UCL	0.367
97.5% Chebyshev(Mean, Sd) UCL	0.433	99% Chebyshev(Mean, Sd) UCL	0.564

Suggested UCL to Use

95% Student's-t UCL	0.279

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	4	Number of Non-Detects	4
Number of Distinct Detects	4	Number of Distinct Non-Detects	4
Minimum Detect	40	Minimum Non-Detect	23
Maximum Detect	760	Maximum Non-Detect	28
Variance Detects	133220	Percent Non-Detects	50%
Mean Detects	347.8	SD Detects	365
Median Detects	295.5	CV Detects	1.05
Skewness Detects	0.279	Kurtosis Detects	-4.413
Mean of Logged Detects	5.086	SD of Logged Detects	1.605

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	185.4	KM Standard Error of Mean	112.8
KM SD	276.3	95% KM (BCA) UCL	N/A
95% KM (t) UCL	399.1	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	370.9	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	523.7	95% KM Chebyshev UCL	677
97.5% KM Chebyshev UCL	889.7	99% KM Chebyshev UCL	1308

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.569	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.67	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.338	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.405	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.779	k star (bias corrected MLE)	0.361
Theta hat (MLE)	446.7	Theta star (bias corrected MLE)	962.5
nu hat (MLE)	6.228	nu star (bias corrected)	2.89
Mean (detects)	347.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	173.9
Maximum	760	Median	20.01
SD	302.7	CV	1.741
k hat (MLE)	0.155	k star (bias corrected MLE)	0.181
Theta hat (MLE)	1118	Theta star (bias corrected MLE)	963.3
nu hat (MLE)	2.488	nu star (bias corrected)	2.888
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (2.89, α)	0.34	Adjusted Chi Square Value (2.89, β)	0.195
95% Gamma Approximate UCL (use when n>=50)	1477	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	185.4	SD (KM)	276.3
Variance (KM)	76323	SE of Mean (KM)	112.8
k hat (KM)	0.45	k star (KM)	0.365
nu hat (KM)	7.204	nu star (KM)	5.836
theta hat (KM)	411.7	theta star (KM)	508.2
80% gamma percentile (KM)	295.5	90% gamma percentile (KM)	531.8
95% gamma percentile (KM)	795	99% gamma percentile (KM)	1463

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.84, α)	1.557	Adjusted Chi Square Value (5.84, β)	1.065
95% Gamma Approximate KM-UCL (use when n>=50)	695	95% Gamma Adjusted KM-UCL (use when n<50)	1015

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.782	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.304	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	174.7	Mean in Log Scale	2.772
SD in Original Scale	302.2	SD in Log Scale	2.688
95% t UCL (assumes normality of ROS data)	377.1	95% Percentile Bootstrap UCL	342.9
95% BCA Bootstrap UCL	380.4	95% Bootstrap t UCL	2586
95% H-UCL (Log ROS)	2234569		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.111	KM Geo Mean	61.01
KM SD (logged)	1.385	95% Critical H Value (KM-Log)	4.427
KM Standard Error of Mean (logged)	0.565	95% H-UCL (KM -Log)	1614
KM SD (logged)	1.385	95% Critical H Value (KM-Log)	4.427
KM Standard Error of Mean (logged)	0.565		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	180.1	Mean in Log Scale	3.805
SD in Original Scale	298.7	SD in Log Scale	1.728
95% t UCL (Assumes normality)	380.2	95% H-Stat UCL	6653

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	399.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
Number of Detects	2	Number of Non-Detects	6
Number of Distinct Detects	2	Number of Distinct Non-Detects	5
Minimum Detect	3.3	Minimum Non-Detect	1.1
Maximum Detect	37	Maximum Non-Detect	13
Variance Detects	567.8	Percent Non-Detects	75%
Mean Detects	20.15	SD Detects	23.83
Median Detects	20.15	CV Detects	1.183
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	2.402	SD of Logged Detects	1.709

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	6.069	KM Standard Error of Mean	5.875
KM SD	11.72	95% KM (BCA) UCL	N/A
95% KM (t) UCL	17.2	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	15.73	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	23.69	95% KM Chebyshev UCL	31.68
97.5% KM Chebyshev UCL	42.76	99% KM Chebyshev UCL	64.53

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.965	k star (bias corrected MLE)	N/A
Theta hat (MLE)	20.88	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.859	nu star (bias corrected)	N/A
Mean (detects)	20.15		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	6.069	SD (KM)	11.72
Variance (KM)	137.5	SE of Mean (KM)	5.875
k hat (KM)	0.268	k star (KM)	0.251
nu hat (KM)	4.287	nu star (KM)	4.012
theta hat (KM)	22.65	theta star (KM)	24.2
80% gamma percentile (KM)	8.824	90% gamma percentile (KM)	18.21
95% gamma percentile (KM)	29.35	99% gamma percentile (KM)	58.98

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0195
Approximate Chi Square Value (4.01, α)	0.727	Adjusted Chi Square Value (4.01, β)	0.445
95% Gamma Approximate KM-UCL (use when n>=50)	33.51	95% Gamma Adjusted KM-UCL (use when n<50)	54.66

Table B.8.2

Summary of ProUCL Output for EU10 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 11:05:33 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin (cont.'d)

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.173	Mean in Log Scale	-0.817
SD in Original Scale	12.91	SD in Log Scale	2.187
95% t UCL (assumes normality of ROS data)	13.82	95% Percentile Bootstrap UCL	14.02
95% BCA Bootstrap UCL	14.79	95% Bootstrap t UCL	773
95% H-UCL (Log ROS)	1196		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.775	KM Geo Mean	2.171
KM SD (logged)	1.161	95% Critical H Value (KM-Log)	3.832
KM Standard Error of Mean (logged)	0.611	95% H-UCL (KM -Log)	22.86
KM SD (logged)	1.161	95% Critical H Value (KM-Log)	3.832
KM Standard Error of Mean (logged)	0.611		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	6.825	Mean in Log Scale	0.909
SD in Original Scale	12.36	SD in Log Scale	1.449
95% t UCL (Assumes normality)	15.1	95% H-Stat UCL	87.95

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

975% KM (Chebyshev) UCL	42.76

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.3

Summary of ProUCL Input Data for EU10 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11	12	13
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenzofuran	D_Dibenzofuran	Aluminum	D_Aluminum	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)
on-site (EU10)	SS-32	10/31/2018	0.25-2.25 ft BGS	210	1	340	1	42	1	24	1	2400	1	4	1	0.25	0
on-site (EU10)	SS-78	10/31/2018	0-2 ft BGS	180	1	270	1	33	1	88	1	9600	1	8.2	1	0.27	0
on-site (EU10)	SS-79	10/31/2018	0-2 ft BGS	270	1	520	1	23	0	270	1	12000	1	27	1	0.3	0
on-site (EU10)	SS-80	10/31/2018	0-2 ft BGS	150	1	250	1	21	0	18	1	4600	1	14	1	0.42	1
on-site (EU10)	SS-81	10/31/2018	0.33-2.33 ft BGS	170	1	310	1	44	1	170	1	6000	1	6.4	1	0.28	0
on-site (EU10)	SS-82	10/31/2018	0-2 ft BGS	28	1	61	1	21	0	14	0	3000	1	6.8	1	0.27	0
on-site (EU10)	SS-83	10/31/2018	0-2 ft BGS	840	1	1300	1	280	1	63	1	3800	1	6	1	0.26	0
on-site (EU10)	SS-84	10/31/2018	0-2 ft BGS	73	1	120	1	21	0	17	1	11000	1	8.6	1	0.44	1
on-site (EU10)	SS-85	10/31/2018	0.25-2.25 ft BGS														
on-site (EU10)	SS-163-AS	10/31/2018	0.33-0.83 ft BGS														
on-site (EU10)	SS-164-AS	10/31/2018	0.25-0.75 ft BGS														
on-site (EU10)	BH117-18	1/18/2018	10-12 ft BGS	190	1	270	1	31	0	0.77	0	8000	1	12	1	1.4	0
on-site (EU10)	BH118-18	1/18/2018	3-5 ft BGS	125	1	305	1	29	0	24	1	2450	1	6.75	1	0.3	1
on-site (EU10)	BH119-18	1/18/2018	9-11 ft BGS	630	1	910	1	51	1	17	1	6100	1	15	1	1.4	0
on-site (EU10)	BH97-17	12/8/2017	13-15 ft BGS	38	1	56	1	31	0	0.765	0	10050	1	9.6	1	0.595	1

Table B.8.3

Summary of ProUCL Input Data for EU10 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				14	15	16	17	18	19	20	21	22	23	24	25	26	27
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Cobalt	D_Cobalt	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Dieldrin	D_Dieldrin
on-site (EU10)	SS-32	10/31/2018	0.25-2.25 ft BGS	2.6	1	0.2	0	7400	1	370	1	0.1	1	23	0	1.1	0
on-site (EU10)	SS-78	10/31/2018	0-2 ft BGS	6.3	1	0.23	0	15000	1	490	1	0.25	1	41	1	3.3	1
on-site (EU10)	SS-79	10/31/2018	0-2 ft BGS	8.9	1	0.3	1	13000	1	220	1	0.27	1	28	0	13	0
on-site (EU10)	SS-80	10/31/2018	0-2 ft BGS	6.3	1	0.2	0	8800	1	240	1	0.38	1	24	0	6	0
on-site (EU10)	SS-81	10/31/2018	0.33-2.33 ft BGS	5.5	1	0.23	1	12000	1	210	1	0.19	1	550	1	37	1
on-site (EU10)	SS-82	10/31/2018	0-2 ft BGS	4.4	1	0.35	1	27000	1	550	1	0.1	1	25	0	1.2	0
on-site (EU10)	SS-83	10/31/2018	0-2 ft BGS	3.2	1	0.21	0	8100	1	250	1	0.13	1	40	1	1.2	0
on-site (EU10)	SS-84	10/31/2018	0-2 ft BGS	7.7	1	0.23	0	18000	1	350	1	0.28	1	760	1	6.1	0
on-site (EU10)	SS-85	10/31/2018	0.25-2.25 ft BGS														
on-site (EU10)	SS-163-AS	10/31/2018	0.33-0.83 ft BGS														
on-site (EU10)	SS-164-AS	10/31/2018	0.25-0.75 ft BGS														
on-site (EU10)	BH117-18	1/18/2018	10-12 ft BGS	6.5	1	0.11	1	18000	1	450	1	0.18	1	26	0	1	0
on-site (EU10)	BH118-18	1/18/2018	3-5 ft BGS	3.9	1	0.1135	1	40000	1	680	1	0.093	1	25	0	0.965	0
on-site (EU10)	BH119-18	1/18/2018	9-11 ft BGS	6.5	1	7.6	1	43000	1	380	1	0.18	1	26	0	1	0
on-site (EU10)	BH97-17	12/8/2017	13-15 ft BGS	8.3	1	0.255	0	20000	1	385	1	0.245	1	26.5	0	5.55	0

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	3
Minimum	28	Mean	242
Maximum	840	Median	175
SD	244.9	Std. Error of Mean	70.7
Coefficient of Variation	1.012	Skewness	1.827

Normal GOF Test

Shapiro Wilk Test Statistic	0.754	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.302	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	369	95% Adjusted-CLT UCL (Chen-1995)	398.1
		95% Modified-t UCL (Johnson-1978)	375.2

Gamma GOF Test

A-D Test Statistic	0.439	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.251	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.326	k star (bias corrected MLE)	1.05
Theta hat (MLE)	182.5	Theta star (bias corrected MLE)	230.5
nu hat (MLE)	31.82	nu star (bias corrected)	25.2
MLE Mean (bias corrected)	242	MLE Sd (bias corrected)	236.2
		Approximate Chi Square Value (0.05)	14.76
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	13.56

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	413	95% Adjusted Gamma UCL (use when n<50)	449.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.155	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.332	Mean of logged Data	5.067
Maximum of Logged Data	6.733	SD of logged Data	0.991

Assuming Lognormal Distribution

95% H-UCL	616.7	90% Chebyshev (MVUE) UCL	470.3
95% Chebyshev (MVUE) UCL	572.3	97.5% Chebyshev (MVUE) UCL	713.7
99% Chebyshev (MVUE) UCL	991.6		

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	358.3	95% Jackknife UCL	369
95% Standard Bootstrap UCL	356.1	95% Bootstrap-t UCL	572.1
95% Hall's Bootstrap UCL	1126	95% Percentile Bootstrap UCL	362.3
95% BCA Bootstrap UCL	390.6		
90% Chebyshev(Mean, Sd) UCL	454.1	95% Chebyshev(Mean, Sd) UCL	550.2
97.5% Chebyshev(Mean, Sd) UCL	683.5	99% Chebyshev(Mean, Sd) UCL	945.5

Suggested UCL to Use

95% Adjusted Gamma UCL	449.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	3
Minimum	56	Mean	392.7
Maximum	1300	Median	287.5
SD	365.9	Std. Error of Mean	105.6
Coefficient of Variation	0.932	Skewness	1.748

Normal GOF Test

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	582.3	95% Adjusted-CLT UCL (Chen-1995)	623.3
		95% Modified-t UCL (Johnson-1978)	591.2

Gamma GOF Test

A-D Test Statistic	0.444	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.206	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.475	k star (bias corrected MLE)	1.162
Theta hat (MLE)	266.3	Theta star (bias corrected MLE)	338
nu hat (MLE)	35.4	nu star (bias corrected)	27.88
MLE Mean (bias corrected)	392.7	MLE Sd (bias corrected)	364.3
		Approximate Chi Square Value (0.05)	16.83
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	15.54

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	650.3	95% Adjusted Gamma UCL (use when n<50)	704.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.218	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.025	Mean of logged Data	5.597
Maximum of Logged Data	7.17	SD of logged Data	0.945

Assuming Lognormal Distribution

95% H-UCL	939.3	90% Chebyshev (MVUE) UCL	750.3
95% Chebyshev (MVUE) UCL	908.5	97.5% Chebyshev (MVUE) UCL	1128
99% Chebyshev (MVUE) UCL	1559		

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	566.4	95% Jackknife UCL	582.3
95% Standard Bootstrap UCL	556	95% Bootstrap-t UCL	832
95% Hall's Bootstrap UCL	1604	95% Percentile Bootstrap UCL	575.4
95% BCA Bootstrap UCL	613.5		
90% Chebyshev(Mean, Sd) UCL	709.5	95% Chebyshev(Mean, Sd) UCL	853.1
97.5% Chebyshev(Mean, Sd) UCL	1052	99% Chebyshev(Mean, Sd) UCL	1444

Suggested UCL to Use

95% Adjusted Gamma UCL	704.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	5	Number of Non-Detects	7
Number of Distinct Detects	5	Number of Distinct Non-Detects	4
Minimum Detect	33	Minimum Non-Detect	21
Maximum Detect	280	Maximum Non-Detect	31
Variance Detects	11323	Percent Non-Detects	58.33%
Mean Detects	90	SD Detects	106.4
Median Detects	44	CV Detects	1.182
Skewness Detects	2.216	Kurtosis Detects	4.928
Mean of Logged Detects	4.117	SD of Logged Detects	0.863

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.611	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.443	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	49.75	KM Standard Error of Mean	22.66
KM SD	70.22	95% KM (BCA) UCL	91.17
95% KM (t) UCL	90.45	95% KM (Percentile Bootstrap) UCL	91
95% KM (z) UCL	87.03	95% KM Bootstrap t UCL	204.5
90% KM Chebyshev UCL	117.7	95% KM Chebyshev UCL	148.5
97.5% KM Chebyshev UCL	191.3	99% KM Chebyshev UCL	275.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.963	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.687	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.431	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.362	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.45	k star (bias corrected MLE)	0.713
Theta hat (MLE)	62.06	Theta star (bias corrected MLE)	126.2
nu hat (MLE)	14.5	nu star (bias corrected)	7.134
Mean (detects)	90		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	37.51
Maximum	280	Median	0.01
SD	79.15	CV	2.11
k hat (MLE)	0.165	k star (bias corrected MLE)	0.179
Theta hat (MLE)	227.4	Theta star (bias corrected MLE)	209.2
nu hat (MLE)	3.958	nu star (bias corrected)	4.302
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (4.30, α)	0.845	Adjusted Chi Square Value (4.30, β)	0.641
95% Gamma Approximate UCL (use when n>=50)	191.1	95% Gamma Adjusted UCL (use when n<50)	251.7

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	49.75	SD (KM)	70.22
Variance (KM)	4931	SE of Mean (KM)	22.66
k hat (KM)	0.502	k star (KM)	0.432
nu hat (KM)	12.05	nu star (KM)	10.37
theta hat (KM)	99.12	theta star (KM)	115.2
80% gamma percentile (KM)	80.93	90% gamma percentile (KM)	138.6
95% gamma percentile (KM)	201.2	99% gamma percentile (KM)	357.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.37, α)	4.173	Adjusted Chi Square Value (10.37, β)	3.593
95% Gamma Approximate KM-UCL (use when n>=50)	123.6	95% Gamma Adjusted KM-UCL (use when n<50)	143.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.724	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	40.53	Mean in Log Scale	2.605
SD in Original Scale	77.64	SD in Log Scale	1.49
95% t UCL (assumes normality of ROS data)	80.78	95% Percentile Bootstrap UCL	82.27
95% BCA Bootstrap UCL	109.1	95% Bootstrap t UCL	176.6
95% H-UCL (Log ROS)	234.4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.491	KM Geo Mean	32.83
KM SD (logged)	0.726	95% Critical H Value (KM-Log)	2.454
KM Standard Error of Mean (logged)	0.234	95% H-UCL (KM -Log)	73.17
KM SD (logged)	0.726	95% Critical H Value (KM-Log)	2.454
KM Standard Error of Mean (logged)	0.234		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	44.88	Mean in Log Scale	3.186
SD in Original Scale	75.55	SD in Log Scale	0.982
95% t UCL (Assumes normality)	84.04	95% H-Stat UCL	92.08

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	148.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	9	Number of Non-Detects	3
Number of Distinct Detects	7	Number of Distinct Non-Detects	3
Minimum Detect	17	Minimum Non-Detect	0.765
Maximum Detect	270	Maximum Non-Detect	14
Variance Detects	7814	Percent Non-Detects	25%
Mean Detects	76.78	SD Detects	88.4
Median Detects	24	CV Detects	1.151
Skewness Detects	1.652	Kurtosis Detects	2.107
Mean of Logged Detects	3.808	SD of Logged Detects	1.064

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.747	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.28	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	57.77	KM Standard Error of Mean	24.29
KM SD	79.33	95% KM (BCA) UCL	100.7
95% KM (t) UCL	101.4	95% KM (Percentile Bootstrap) UCL	98.71
95% KM (z) UCL	97.73	95% KM Bootstrap t UCL	165.1
90% KM Chebyshev UCL	130.6	95% KM Chebyshev UCL	163.6
97.5% KM Chebyshev UCL	209.5	99% KM Chebyshev UCL	299.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.719	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.302	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.286	Detected Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.073	k star (bias corrected MLE)	0.79
Theta hat (MLE)	71.53	Theta star (bias corrected MLE)	97.23
nu hat (MLE)	19.32	nu star (bias corrected)	14.21
Mean (detects)	76.78		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	57.59
Maximum	270	Median	21
SD	83	CV	1.441
k hat (MLE)	0.294	k star (bias corrected MLE)	0.276
Theta hat (MLE)	195.6	Theta star (bias corrected MLE)	208.3
nu hat (MLE)	7.067	nu star (bias corrected)	6.634
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (6.63, α)	1.972	Adjusted Chi Square Value (6.63, β)	1.609
95% Gamma Approximate UCL (use when n>=50)	193.7	95% Gamma Adjusted UCL (use when n<50)	237.5

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenzofuran (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	57.77	SD (KM)	79.33
Variance (KM)	6293	SE of Mean (KM)	24.29
k hat (KM)	0.53	k star (KM)	0.453
nu hat (KM)	12.73	nu star (KM)	10.88
theta hat (KM)	108.9	theta star (KM)	127.4
80% gamma percentile (KM)	94.35	90% gamma percentile (KM)	159.4
95% gamma percentile (KM)	229.8	99% gamma percentile (KM)	404.4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.88, α)	4.5	Adjusted Chi Square Value (10.88, β)	3.893
95% Gamma Approximate KM-UCL (use when n>=50)	139.7	95% Gamma Adjusted KM-UCL (use when n<50)	161.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.278	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	58.47	Mean in Log Scale	3.172
SD in Original Scale	82.34	SD in Log Scale	1.464
95% t UCL (assumes normality of ROS data)	101.2	95% Percentile Bootstrap UCL	99.75
95% BCA Bootstrap UCL	109.3	95% Bootstrap t UCL	170.7
95% H-UCL (Log ROS)	377		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.789	KM Geo Mean	16.26
KM SD (logged)	1.967	95% Critical H Value (KM-Log)	4.89
KM Standard Error of Mean (logged)	0.602	95% H-UCL (KM -Log)	2046
KM SD (logged)	1.967	95% Critical H Value (KM-Log)	4.89
KM Standard Error of Mean (logged)	0.602		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	58.23	Mean in Log Scale	2.858
SD in Original Scale	82.53	SD in Log Scale	2.07
95% t UCL (Assumes normality)	101	95% H-Stat UCL	3614

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	165.1	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	161.5

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	3
Minimum	2400	Mean	6583
Maximum	12000	Median	6050
SD	3460	Std. Error of Mean	998.7
Coefficient of Variation	0.525	Skewness	0.257

Normal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8377	95% Adjusted-CLT UCL (Chen-1995)	8305
		95% Modified-t UCL (Johnson-1978)	8389

Gamma GOF Test

A-D Test Statistic	0.37	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.158	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.247	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.583	k star (bias corrected MLE)	2.743
Theta hat (MLE)	1837	Theta star (bias corrected MLE)	2400
nu hat (MLE)	86	nu star (bias corrected)	65.84
MLE Mean (bias corrected)	6583	MLE Sd (bias corrected)	3975
		Approximate Chi Square Value (0.05)	48.16
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	45.87

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8999	95% Adjusted Gamma UCL (use when n<50)	9450

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.783	Mean of logged Data	8.646
Maximum of Logged Data	9.393	SD of logged Data	0.587

Assuming Lognormal Distribution

95% H-UCL	10065	90% Chebyshev (MVUE) UCL	10132
95% Chebyshev (MVUE) UCL	11710	97.5% Chebyshev (MVUE) UCL	13900
99% Chebyshev (MVUE) UCL	18203		

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8226	95% Jackknife UCL	8377
95% Standard Bootstrap UCL	8118	95% Bootstrap-t UCL	8451
95% Hall's Bootstrap UCL	8054	95% Percentile Bootstrap UCL	8225
95% BCA Bootstrap UCL	8167		
90% Chebyshev(Mean, Sd) UCL	9579	95% Chebyshev(Mean, Sd) UCL	10936
97.5% Chebyshev(Mean, Sd) UCL	12820	99% Chebyshev(Mean, Sd) UCL	16520

Suggested UCL to Use

95% Student's-t UCL	8377

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	3
Minimum	4	Mean	10.36
Maximum	27	Median	8.4
SD	6.205	Std. Error of Mean	1.791
Coefficient of Variation	0.599	Skewness	1.939

Normal GOF Test

Shapiro Wilk Test Statistic	0.806	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	13.58	95% Adjusted-CLT UCL (Chen-1995)	14.38
		95% Modified-t UCL (Johnson-1978)	13.75

Gamma GOF Test

A-D Test Statistic	0.414	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.16	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.025	k star (bias corrected MLE)	3.074
Theta hat (MLE)	2.574	Theta star (bias corrected MLE)	3.371
nu hat (MLE)	96.6	nu star (bias corrected)	73.79
MLE Mean (bias corrected)	10.36	MLE Sd (bias corrected)	5.91
		Approximate Chi Square Value (0.05)	55
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	52.54

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	13.9	95% Adjusted Gamma UCL (use when n<50)	14.55

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.133	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.386	Mean of logged Data	2.209
Maximum of Logged Data	3.296	SD of logged Data	0.51

Assuming Lognormal Distribution

95% H-UCL	14.44	90% Chebyshev (MVUE) UCL	14.88
95% Chebyshev (MVUE) UCL	16.98	97.5% Chebyshev (MVUE) UCL	19.89
99% Chebyshev (MVUE) UCL	25.62		

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13.31	95% Jackknife UCL	13.58
95% Standard Bootstrap UCL	13.16	95% Bootstrap-t UCL	16.03
95% Hall's Bootstrap UCL	25.86	95% Percentile Bootstrap UCL	13.48
95% BCA Bootstrap UCL	14.31		
90% Chebyshev(Mean, Sd) UCL	15.74	95% Chebyshev(Mean, Sd) UCL	18.17
97.5% Chebyshev(Mean, Sd) UCL	21.55	99% Chebyshev(Mean, Sd) UCL	28.19

Suggested UCL to Use

95% Student's-t UCL	13.58

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	4	Number of Non-Detects	8
Number of Distinct Detects	4	Number of Distinct Non-Detects	6
Minimum Detect	0.3	Minimum Non-Detect	0.25
Maximum Detect	0.595	Maximum Non-Detect	1.4
Variance Detects	0.0147	Percent Non-Detects	66.67%
Mean Detects	0.439	SD Detects	0.121
Median Detects	0.43	CV Detects	0.276
Skewness Detects	0.426	Kurtosis Detects	1.469
Mean of Logged Detects	-0.853	SD of Logged Detects	0.28

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.326	KM Standard Error of Mean	0.0416
KM SD	0.114	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.4	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.394	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.45	95% KM Chebyshev UCL	0.507
97.5% KM Chebyshev UCL	0.585	99% KM Chebyshev UCL	0.739

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.265	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.394	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	17.36	k star (bias corrected MLE)	4.505
Theta hat (MLE)	0.0253	Theta star (bias corrected MLE)	0.0974
nu hat (MLE)	138.8	nu star (bias corrected)	36.04
Mean (detects)	0.439		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.213
Maximum	0.595	Median	0.11
SD	0.192	CV	0.899
k hat (MLE)	1.154	k star (bias corrected MLE)	0.921
Theta hat (MLE)	0.185	Theta star (bias corrected MLE)	0.232
nu hat (MLE)	27.7	nu star (bias corrected)	22.11
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (22.11, α)	12.42	Adjusted Chi Square Value (22.11, β)	11.32
95% Gamma Approximate UCL (use when n>=50)	0.38	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.326	SD (KM)	0.114
Variance (KM)	0.013	SE of Mean (KM)	0.0416
k hat (KM)	8.18	k star (KM)	6.191
nu hat (KM)	196.3	nu star (KM)	148.6
theta hat (KM)	0.0398	theta star (KM)	0.0526
80% gamma percentile (KM)	0.427	90% gamma percentile (KM)	0.5
95% gamma percentile (KM)	0.566	99% gamma percentile (KM)	0.704

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (148.57, α)	121.4	Adjusted Chi Square Value (148.57, β)	117.7
95% Gamma Approximate KM-UCL (use when n>=50)	0.398	95% Gamma Adjusted KM-UCL (use when n<50)	0.411

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.27	Mean in Log Scale	-1.428
SD in Original Scale	0.147	SD in Log Scale	0.491
95% t UCL (assumes normality of ROS data)	0.346	95% Percentile Bootstrap UCL	0.339
95% BCA Bootstrap UCL	0.352	95% Bootstrap t UCL	0.384
95% H-UCL (Log ROS)	0.371		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.173	KM Geo Mean	0.309
KM SD (logged)	0.303	95% Critical H Value (KM-Log)	1.93
KM Standard Error of Mean (logged)	0.111	95% H-UCL (KM -Log)	0.386
KM SD (logged)	0.303	95% Critical H Value (KM-Log)	1.93
KM Standard Error of Mean (logged)	0.111		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.331	Mean in Log Scale	-1.343
SD in Original Scale	0.232	SD in Log Scale	0.722
95% t UCL (Assumes normality)	0.451	95% H-Stat UCL	0.577

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	2.6	Mean	5.842
Maximum	8.9	Median	6.3
SD	1.991	Std. Error of Mean	0.575
Coefficient of Variation	0.341	Skewness	-0.169

Normal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.874	95% Adjusted-CLT UCL (Chen-1995)	6.757
		95% Modified-t UCL (Johnson-1978)	6.869

Gamma GOF Test

A-D Test Statistic	0.37	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.215	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.206	k star (bias corrected MLE)	6.21
Theta hat (MLE)	0.712	Theta star (bias corrected MLE)	0.941
nu hat (MLE)	197	nu star (bias corrected)	149
MLE Mean (bias corrected)	5.842	MLE Sd (bias corrected)	2.344
		Approximate Chi Square Value (0.05)	121.8
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	118.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7.147	95% Adjusted Gamma UCL (use when n<50)	7.374

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.223	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.956	Mean of logged Data	1.703
Maximum of Logged Data	2.186	SD of logged Data	0.385

Assuming Lognormal Distribution

95% H-UCL	7.465	90% Chebyshev (MVUE) UCL	7.86
95% Chebyshev (MVUE) UCL	8.759	97.5% Chebyshev (MVUE) UCL	10.01
99% Chebyshev (MVUE) UCL	12.46		

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.787	95% Jackknife UCL	6.874
95% Standard Bootstrap UCL	6.739	95% Bootstrap-t UCL	6.82
95% Hall's Bootstrap UCL	6.786	95% Percentile Bootstrap UCL	6.767
95% BCA Bootstrap UCL	6.692		
90% Chebyshev(Mean, Sd) UCL	7.566	95% Chebyshev(Mean, Sd) UCL	8.347
97.5% Chebyshev(Mean, Sd) UCL	9.43	99% Chebyshev(Mean, Sd) UCL	11.56

Suggested UCL to Use

95% Student's-t UCL	6.874

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	12	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	6	Number of Non-Detects	6
Number of Distinct Detects	6	Number of Distinct Non-Detects	4
Minimum Detect	0.11	Minimum Non-Detect	0.2
Maximum Detect	7.6	Maximum Non-Detect	0.255
Variance Detects	9.085	Percent Non-Detects	50%
Mean Detects	1.451	SD Detects	3.014
Median Detects	0.265	CV Detects	2.078
Skewness Detects	2.444	Kurtosis Detects	5.978
Mean of Logged Detects	-1.013	SD of Logged Detects	1.567

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.526	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.476	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.782	KM Standard Error of Mean	0.651
KM SD	2.057	95% KM (BCA) UCL	2.067
95% KM (t) UCL	1.951	95% KM (Percentile Bootstrap) UCL	2.012
95% KM (z) UCL	1.852	95% KM Bootstrap t UCL	21.12
90% KM Chebyshev UCL	2.734	95% KM Chebyshev UCL	3.618
97.5% KM Chebyshev UCL	4.845	99% KM Chebyshev UCL	7.255

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.107	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.741	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.439	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.35	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.464	k star (bias corrected MLE)	0.343
Theta hat (MLE)	3.126	Theta star (bias corrected MLE)	4.228
nu hat (MLE)	5.568	nu star (bias corrected)	4.117
Mean (detects)	1.451		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.73
Maximum	7.6	Median	0.06
SD	2.167	CV	2.967
k hat (MLE)	0.28	k star (bias corrected MLE)	0.265
Theta hat (MLE)	2.612	Theta star (bias corrected MLE)	2.753
nu hat (MLE)	6.71	nu star (bias corrected)	6.366
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (6.37, α)	1.83	Adjusted Chi Square Value (6.37, β)	1.484
95% Gamma Approximate UCL (use when n>=50)	2.541	95% Gamma Adjusted UCL (use when n<50)	3.133

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.782	SD (KM)	2.057
Variance (KM)	4.232	SE of Mean (KM)	0.651
k hat (KM)	0.145	k star (KM)	0.164
nu hat (KM)	3.471	nu star (KM)	3.937
theta hat (KM)	5.409	theta star (KM)	4.77
80% gamma percentile (KM)	0.912	90% gamma percentile (KM)	2.344
95% gamma percentile (KM)	4.228	99% gamma percentile (KM)	9.597

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.94, α)	0.697	Adjusted Chi Square Value (3.94, β)	0.521
95% Gamma Approximate KM-UCL (use when n>=50)	4.42	95% Gamma Adjusted KM-UCL (use when n<50)	5.917

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.764	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.343	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.774	Mean in Log Scale	-1.708
SD in Original Scale	2.152	SD in Log Scale	1.311
95% t UCL (assumes normality of ROS data)	1.889	95% Percentile Bootstrap UCL	2.006
95% BCA Bootstrap UCL	2.653	95% Bootstrap t UCL	20.79
95% H-UCL (Log ROS)	1.713		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.595	KM Geo Mean	0.203
KM SD (logged)	1.169	95% Critical H Value (KM-Log)	3.231
KM Standard Error of Mean (logged)	0.37	95% H-UCL (KM -Log)	1.255
KM SD (logged)	1.169	95% Critical H Value (KM-Log)	3.231
KM Standard Error of Mean (logged)	0.37		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.781	Mean in Log Scale	-1.61
SD in Original Scale	2.149	SD in Log Scale	1.228
95% t UCL (Assumes normality)	1.895	95% H-Stat UCL	1.468

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

975% KM (Chebyshev) UCL	4.845

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	12	Number of Distinct Observations	11
		Number of Missing Observations	3
Minimum	7400	Mean	19192
Maximum	43000	Median	16500
SD	11840	Std. Error of Mean	3418
Coefficient of Variation	0.617	Skewness	1.194

Normal GOF Test

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.223	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	25330	95% Adjusted-CLT UCL (Chen-1995)	26073
		95% Modified-t UCL (Johnson-1978)	25526

Gamma GOF Test

A-D Test Statistic	0.361	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.738	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.148	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.247	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.306	k star (bias corrected MLE)	2.535
Theta hat (MLE)	5804	Theta star (bias corrected MLE)	7570
nu hat (MLE)	79.35	nu star (bias corrected)	60.85
MLE Mean (bias corrected)	19192	MLE Sd (bias corrected)	12053
		Approximate Chi Square Value (0.05)	43.91
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	41.72

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	26595	95% Adjusted Gamma UCL (use when n<50)	27991

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.115	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.909	Mean of logged Data	9.703
Maximum of Logged Data	10.67	SD of logged Data	0.581

Assuming Lognormal Distribution

95% H-UCL	28706	90% Chebyshev (MVUE) UCL	28960
95% Chebyshev (MVUE) UCL	33438	97.5% Chebyshev (MVUE) UCL	39653
99% Chebyshev (MVUE) UCL	51861		

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	24814	95% Jackknife UCL	25330
95% Standard Bootstrap UCL	24649	95% Bootstrap-t UCL	28867
95% Hall's Bootstrap UCL	30635	95% Percentile Bootstrap UCL	24775
95% BCA Bootstrap UCL	25692		
90% Chebyshev(Mean, Sd) UCL	29445	95% Chebyshev(Mean, Sd) UCL	34090
97.5% Chebyshev(Mean, Sd) UCL	40536	99% Chebyshev(Mean, Sd) UCL	53199

Suggested UCL to Use

95% Student's-t UCL 25330

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	3
Minimum	210	Mean	381.3
Maximum	680	Median	375
SD	143.9	Std. Error of Mean	41.55
Coefficient of Variation	0.378	Skewness	0.686

Normal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.156	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	455.9	95% Adjusted-CLT UCL (Chen-1995)	458.4
		95% Modified-t UCL (Johnson-1978)	457.2

Gamma GOF Test

A-D Test Statistic	0.303	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.171	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.874	k star (bias corrected MLE)	5.961
Theta hat (MLE)	48.42	Theta star (bias corrected MLE)	63.96
nu hat (MLE)	189	nu star (bias corrected)	143.1
MLE Mean (bias corrected)	381.3	MLE Sd (bias corrected)	156.2
		Approximate Chi Square Value (0.05)	116.4
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	112.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	468.5	95% Adjusted Gamma UCL (use when n<50)	483.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.347	Mean of logged Data	5.879
Maximum of Logged Data	6.522	SD of logged Data	0.378

Assuming Lognormal Distribution

95% H-UCL	481.9	90% Chebyshev (MVUE) UCL	507.7
95% Chebyshev (MVUE) UCL	565	97.5% Chebyshev (MVUE) UCL	644.5
99% Chebyshev (MVUE) UCL	800.6		

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	449.6	95% Jackknife UCL	455.9
95% Standard Bootstrap UCL	445.7	95% Bootstrap-t UCL	467.8
95% Hall's Bootstrap UCL	469.1	95% Percentile Bootstrap UCL	449.6
95% BCA Bootstrap UCL	453.8		
90% Chebyshev(Mean, Sd) UCL	505.9	95% Chebyshev(Mean, Sd) UCL	562.4
97.5% Chebyshev(Mean, Sd) UCL	640.7	99% Chebyshev(Mean, Sd) UCL	794.7

Suggested UCL to Use

95% Student's-t UCL	455.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	0.093	Mean	0.2
Maximum	0.38	Median	0.185
SD	0.0881	Std. Error of Mean	0.0254
Coefficient of Variation	0.441	Skewness	0.535

Normal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.128	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.246	95% Adjusted-CLT UCL (Chen-1995)	0.246
		95% Modified-t UCL (Johnson-1978)	0.246

Gamma GOF Test

A-D Test Statistic	0.36	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.154	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.47	k star (bias corrected MLE)	4.158
Theta hat (MLE)	0.0365	Theta star (bias corrected MLE)	0.0481
nu hat (MLE)	131.3	nu star (bias corrected)	99.79
MLE Mean (bias corrected)	0.2	MLE Sd (bias corrected)	0.098
		Approximate Chi Square Value (0.05)	77.74
Adjusted Level of Significance	0.029	Adjusted Chi Square Value	74.78

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.257	95% Adjusted Gamma UCL (use when n<50)	0.267

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.859	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.243	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.375	Mean of logged Data	-1.704
Maximum of Logged Data	-0.968	SD of logged Data	0.463

Assuming Lognormal Distribution

95% H-UCL	0.271	90% Chebyshev (MVUE) UCL	0.282
95% Chebyshev (MVUE) UCL	0.32	97.5% Chebyshev (MVUE) UCL	0.371
99% Chebyshev (MVUE) UCL	0.472		

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.242	95% Jackknife UCL	0.246
95% Standard Bootstrap UCL	0.239	95% Bootstrap-t UCL	0.25
95% Hall's Bootstrap UCL	0.25	95% Percentile Bootstrap UCL	0.241
95% BCA Bootstrap UCL	0.245		
90% Chebyshev(Mean, Sd) UCL	0.276	95% Chebyshev(Mean, Sd) UCL	0.311
97.5% Chebyshev(Mean, Sd) UCL	0.359	99% Chebyshev(Mean, Sd) UCL	0.453

Suggested UCL to Use

95% Student's-t UCL	0.246

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	4	Number of Non-Detects	8
Number of Distinct Detects	4	Number of Distinct Non-Detects	6
Minimum Detect	40	Minimum Non-Detect	23
Maximum Detect	760	Maximum Non-Detect	28
Variance Detects	133220	Percent Non-Detects	66.67%
Mean Detects	347.8	SD Detects	365
Median Detects	295.5	CV Detects	1.05
Skewness Detects	0.279	Kurtosis Detects	-4.413
Mean of Logged Detects	5.086	SD of Logged Detects	1.605

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	131.3	KM Standard Error of Mean	79.4
KM SD	238.2	95% KM (BCA) UCL	N/A
95% KM (t) UCL	273.8	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	261.9	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	369.5	95% KM Chebyshev UCL	477.4
97.5% KM Chebyshev UCL	627.1	99% KM Chebyshev UCL	921.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.569	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.67	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.338	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.405	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.779	k star (bias corrected MLE)	0.361
Theta hat (MLE)	446.7	Theta star (bias corrected MLE)	962.5
nu hat (MLE)	6.228	nu star (bias corrected)	2.89
Mean (detects)	347.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	115.9
Maximum	760	Median	0.01
SD	256.2	CV	2.21
k hat (MLE)	0.128	k star (bias corrected MLE)	0.152
Theta hat (MLE)	903.9	Theta star (bias corrected MLE)	764
nu hat (MLE)	3.078	nu star (bias corrected)	3.642
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (3.64, α)	0.586	Adjusted Chi Square Value (3.64, β)	0.431
95% Gamma Approximate UCL (use when n>=50)	721	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	131.3	SD (KM)	238.2
Variance (KM)	56741	SE of Mean (KM)	79.4
k hat (KM)	0.304	k star (KM)	0.283
nu hat (KM)	7.286	nu star (KM)	6.798
theta hat (KM)	432.3	theta star (KM)	463.4
80% gamma percentile (KM)	198.3	90% gamma percentile (KM)	389.6
95% gamma percentile (KM)	611.5	99% gamma percentile (KM)	1192

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.80, α)	2.06	Adjusted Chi Square Value (6.80, β)	1.687
95% Gamma Approximate KM-UCL (use when n>=50)	433	95% Gamma Adjusted KM-UCL (use when n<50)	529

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.782	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.304	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	116.5	Mean in Log Scale	1.331
SD in Original Scale	256	SD in Log Scale	2.987
95% t UCL (assumes normality of ROS data)	249.1	95% Percentile Bootstrap UCL	243
95% BCA Bootstrap UCL	288.7	95% Bootstrap t UCL	1912
95% H-UCL (Log ROS)	207607		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.786	KM Geo Mean	44.07
KM SD (logged)	1.221	95% Critical H Value (KM-Log)	3.331
KM Standard Error of Mean (logged)	0.407	95% H-UCL (KM -Log)	316.2
KM SD (logged)	1.221	95% Critical H Value (KM-Log)	3.331
KM Standard Error of Mean (logged)	0.407		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	124.4	Mean in Log Scale	3.39
SD in Original Scale	252.1	SD in Log Scale	1.508
95% t UCL (Assumes normality)	255.1	95% H-Stat UCL	548.3

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	273.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	2	Number of Non-Detects	10
Number of Distinct Detects	2	Number of Distinct Non-Detects	8
Minimum Detect	3.3	Minimum Non-Detect	0.965
Maximum Detect	37	Maximum Non-Detect	13
Variance Detects	567.8	Percent Non-Detects	83.33%
Mean Detects	20.15	SD Detects	23.83
Median Detects	20.15	CV Detects	1.183
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	2.402	SD of Logged Detects	1.709

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.274	KM Standard Error of Mean	4.048
KM SD	9.898	95% KM (BCA) UCL	N/A
95% KM (t) UCL	11.54	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	10.93	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	16.42	95% KM Chebyshev UCL	21.92
97.5% KM Chebyshev UCL	29.55	99% KM Chebyshev UCL	44.55

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.965	k star (bias corrected MLE)	N/A
Theta hat (MLE)	20.88	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.859	nu star (bias corrected)	N/A
Mean (detects)	20.15		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.274	SD (KM)	9.898
Variance (KM)	97.98	SE of Mean (KM)	4.048
k hat (KM)	0.186	k star (KM)	0.195
nu hat (KM)	4.474	nu star (KM)	4.689
theta hat (KM)	22.93	theta star (KM)	21.88
80% gamma percentile (KM)	5.561	90% gamma percentile (KM)	12.92
95% gamma percentile (KM)	22.15	99% gamma percentile (KM)	47.67

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.029
Approximate Chi Square Value (4.69, α)	1.011	Adjusted Chi Square Value (4.69, β)	0.78
95% Gamma Approximate KM-UCL (use when n>=50)	19.82	95% Gamma Adjusted KM-UCL (use when n<50)	25.7

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Table B.8.4

Summary of ProUCL Output for EU10 Surface and Subsurface Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 2:49:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin (cont.'d)

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.403	Mean in Log Scale	-2.263
SD in Original Scale	10.62	SD in Log Scale	2.375
95% t UCL (assumes normality of ROS data)	8.909	95% Percentile Bootstrap UCL	9.287
95% BCA Bootstrap UCL	12.64	95% Bootstrap t UCL	1130
95% H-UCL (Log ROS)	110.3		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.429	KM Geo Mean	1.536
KM SD (logged)	1.044	95% Critical H Value (KM-Log)	2.995
KM Standard Error of Mean (logged)	0.445	95% H-UCL (KM -Log)	6.801
KM SD (logged)	1.044	95% Critical H Value (KM-Log)	2.995
KM Standard Error of Mean (logged)	0.445		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.905	Mean in Log Scale	0.515
SD in Original Scale	10.27	SD in Log Scale	1.37
95% t UCL (Assumes normality)	10.23	95% H-Stat UCL	19.16

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

975% KM (Chebyshev) UCL	29.55

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.1

Summary of ProUCL Input Data for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Aluminum	D_Aluminum
on-site (EU11)	SS-25	11/1/2017	0-2 ft BGS	25	1	33	1	59	1	29	0	0.71	0	3500	1
on-site (EU11)	SS-70	10/30/2018	0-2 ft BGS	130	1	120	1	200	1	39	1	28	1	4500	1
on-site (EU11)	SS-71	10/30/2018	0-2 ft BGS	61	1	80	1	100	1	25	1	19	1	9000	1
on-site (EU11)	SS-72	10/30/2018	0.5-2.25 ft BGS	400	1	380	1	580	1	62	1	57	1	4200	1
on-site (EU11)	SS-73	10/30/2018	0.17-2.17 ft BGS	410	1	410	1	570	1	46	1	74	1	4100	1
on-site (EU11)	SS-74	10/30/2018	0-2 ft BGS	1200	1	1400	1	2000	1	120	1	220	1	3300	1
on-site (EU11)	SS-75	10/30/2018	0.5-2.5 ft BGS	470	1	440	1	550	1	83	1	61	1	11000	1
on-site (EU11)	SS-76	10/30/2018	0-2 ft BGS	11	1	11	0	14	1	22	0	8	0	4500	1
on-site (EU11)	SS-77	10/30/2018	0.5-2.5 ft BGS												
on-site (EU11)	SS-165-AS	10/30/2018	0.5-1 ft BGS												
on-site (EU11)	SS-166-AS	10/30/2018	0.5-1 ft BGS												

Table B.9.1

Summary of ProUCL Input Data for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23	24	25
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU11)	SS-25	11/1/2017	0-2 ft BGS	3.9	1	3.6	1	4.7	1	15000	1	390	1	0.12	1	390	1
on-site (EU11)	SS-70	10/30/2018	0-2 ft BGS	6.5	1	0.26	0	3.7	1	17000	1	390	1	0.13	1	24	0
on-site (EU11)	SS-71	10/30/2018	0-2 ft BGS	13	1	0.27	0	5.4	1	14000	1	480	1	0.16	1	25	0
on-site (EU11)	SS-72	10/30/2018	0.5-2.25 ft BGS	6.1	1	0.26	0	3.5	1	8900	1	330	1	0.12	1	96	1
on-site (EU11)	SS-73	10/30/2018	0.17-2.17 ft BGS	5.2	1	0.28	0	3.5	1	8200	1	280	1	0.13	1	25	0
on-site (EU11)	SS-74	10/30/2018	0-2 ft BGS	7.1	1	0.26	0	3.8	1	20000	1	390	1	0.095	0	140	1
on-site (EU11)	SS-75	10/30/2018	0.5-2.5 ft BGS	11	1	1.4	0	6.9	1	25000	1	290	1	0.24	1	910	1
on-site (EU11)	SS-76	10/30/2018	0-2 ft BGS	8.1	1	0.6	1	6.2	1	12000	1	550	1	0.17	1	26	0
on-site (EU11)	SS-77	10/30/2018	0.5-2.5 ft BGS														
on-site (EU11)	SS-165-AS	10/30/2018	0.5-1 ft BGS														
on-site (EU11)	SS-166-AS	10/30/2018	0.5-1 ft BGS														

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	11	Mean	338.4
Maximum	1200	Median	265
SD	395.4	Std. Error of Mean	139.8
Coefficient of Variation	1.169	Skewness	1.683

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	603.2	95% Adjusted-CLT UCL (Chen-1995)	657.2
		95% Modified-t UCL (Johnson-1978)	617.1

Gamma GOF Test

A-D Test Statistic	0.276	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.305	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.714	k star (bias corrected MLE)	0.53
Theta hat (MLE)	473.6	Theta star (bias corrected MLE)	638.6
nu hat (MLE)	11.43	nu star (bias corrected)	8.478
MLE Mean (bias corrected)	338.4	MLE Sd (bias corrected)	464.8
		Approximate Chi Square Value (0.05)	3.015
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	2.254

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	951.5	95% Adjusted Gamma UCL (use when n<50)	1273

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.398	Mean of logged Data	4.981
Maximum of Logged Data	7.09	SD of logged Data	1.624

Assuming Lognormal Distribution

95% H-UCL	12313	90% Chebyshev (MVUE) UCL	1116
95% Chebyshev (MVUE) UCL	1436	97.5% Chebyshev (MVUE) UCL	1879
99% Chebyshev (MVUE) UCL	2751		

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	568.3	95% Jackknife UCL	603.2
95% Standard Bootstrap UCL	561.6	95% Bootstrap-t UCL	786.8
95% Hall's Bootstrap UCL	1440	95% Percentile Bootstrap UCL	571.9
95% BCA Bootstrap UCL	627.6		
90% Chebyshev(Mean, Sd) UCL	757.8	95% Chebyshev(Mean, Sd) UCL	947.7
97.5% Chebyshev(Mean, Sd) UCL	1211	99% Chebyshev(Mean, Sd) UCL	1729

Suggested UCL to Use

95% Student's-t UCL	603.2

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	33	Minimum Non-Detect	11
Maximum Detect	1400	Maximum Non-Detect	11
Variance Detects	219504	Percent Non-Detects	12.5%
Mean Detects	409	SD Detects	468.5
Median Detects	380	CV Detects	1.146
Skewness Detects	1.952	Kurtosis Detects	4.316
Mean of Logged Detects	5.422	SD of Logged Detects	1.263

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.762	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.331	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	359.3	KM Standard Error of Mean	162.9
KM SD	426.6	95% KM (BCA) UCL	646.8
95% KM (t) UCL	667.9	95% KM (Percentile Bootstrap) UCL	650.1
95% KM (z) UCL	627.2	95% KM Bootstrap t UCL	961.7
90% KM Chebyshev UCL	847.9	95% KM Chebyshev UCL	1069
97.5% KM Chebyshev UCL	1377	99% KM Chebyshev UCL	1980

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.312	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.197	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.32	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.978	k star (bias corrected MLE)	0.654
Theta hat (MLE)	418.2	Theta star (bias corrected MLE)	625.3
nu hat (MLE)	13.69	nu star (bias corrected)	9.157
Mean (detects)	409		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	357.9
Maximum	1400	Median	250
SD	457.2	CV	1.278
k hat (MLE)	0.387	k star (bias corrected MLE)	0.325
Theta hat (MLE)	925.8	Theta star (bias corrected MLE)	1101
nu hat (MLE)	6.185	nu star (bias corrected)	5.199
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (5.20, α)	1.245	Adjusted Chi Square Value (5.20, β)	0.825
95% Gamma Approximate UCL (use when n>=50)	1494	95% Gamma Adjusted UCL (use when n<50)	2255

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	359.3	SD (KM)	426.6
Variance (KM)	181953	SE of Mean (KM)	162.9
k hat (KM)	0.709	k star (KM)	0.527
nu hat (KM)	11.35	nu star (KM)	8.426
theta hat (KM)	506.5	theta star (KM)	682.1
80% gamma percentile (KM)	591.1	90% gamma percentile (KM)	961.4
95% gamma percentile (KM)	1355	99% gamma percentile (KM)	2317

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.43, α)	2.984	Adjusted Chi Square Value (8.43, β)	2.228
95% Gamma Approximate KM-UCL (use when n>=50)	1014	95% Gamma Adjusted KM-UCL (use when n<50)	1359

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	359.1	Mean in Log Scale	5.033
SD in Original Scale	456.1	SD in Log Scale	1.606
95% t UCL (assumes normality of ROS data)	664.7	95% Percentile Bootstrap UCL	639.1
95% BCA Bootstrap UCL	711.3	95% Bootstrap t UCL	960
95% H-UCL (Log ROS)	11801		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.044	KM Geo Mean	155.1
KM SD (logged)	1.482	95% Critical H Value (KM-Log)	4.692
KM Standard Error of Mean (logged)	0.566	95% H-UCL (KM -Log)	6447
KM SD (logged)	1.482	95% Critical H Value (KM-Log)	4.692
KM Standard Error of Mean (logged)	0.566		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	358.6	Mean in Log Scale	4.957
SD in Original Scale	456.6	SD in Log Scale	1.759
95% t UCL (Assumes normality)	664.4	95% H-Stat UCL	25186

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	961.7	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	1359

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	14	Mean	509.1
Maximum	2000	Median	375
SD	648.5	Std. Error of Mean	229.3
Coefficient of Variation	1.274	Skewness	2.098

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.732	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.331	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	943.5	95% Adjusted-CLT UCL (Chen-1995)	1068
		95% Modified-t UCL (Johnson-1978)	971.9

Gamma GOF Test

A-D Test Statistic	0.274	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.181	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.305	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.726	k star (bias corrected MLE)	0.537
Theta hat (MLE)	700.9	Theta star (bias corrected MLE)	947.5
nu hat (MLE)	11.62	nu star (bias corrected)	8.597
MLE Mean (bias corrected)	509.1	MLE Sd (bias corrected)	694.6
		Approximate Chi Square Value (0.05)	3.085
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	2.313

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1419	95% Adjusted Gamma UCL (use when n<50)	1893

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.639	Mean of logged Data	5.405
Maximum of Logged Data	7.601	SD of logged Data	1.581

Assuming Lognormal Distribution

95% H-UCL	15104	90% Chebyshev (MVUE) UCL	1601
95% Chebyshev (MVUE) UCL	2055	97.5% Chebyshev (MVUE) UCL	2686
99% Chebyshev (MVUE) UCL	3925		

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	886.3	95% Jackknife UCL	943.5
95% Standard Bootstrap UCL	860.2	95% Bootstrap-t UCL	1367
95% Hall's Bootstrap UCL	2284	95% Percentile Bootstrap UCL	909
95% BCA Bootstrap UCL	1065		
90% Chebyshev(Mean, Sd) UCL	1197	95% Chebyshev(Mean, Sd) UCL	1509
97.5% Chebyshev(Mean, Sd) UCL	1941	99% Chebyshev(Mean, Sd) UCL	2790

Suggested UCL to Use

95% Adjusted Gamma UCL	1893

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	25	Minimum Non-Detect	22
Maximum Detect	120	Maximum Non-Detect	29
Variance Detects	1192	Percent Non-Detects	25%
Mean Detects	62.5	SD Detects	34.52
Median Detects	54	CV Detects	0.552
Skewness Detects	0.937	Kurtosis Detects	0.389
Mean of Logged Detects	4.007	SD of Logged Detects	0.559

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	52.56	KM Standard Error of Mean	12.5
KM SD	32.27	95% KM (BCA) UCL	72.75
95% KM (t) UCL	76.25	95% KM (Percentile Bootstrap) UCL	72.25
95% KM (z) UCL	73.12	95% KM Bootstrap t UCL	87.37
90% KM Chebyshev UCL	90.06	95% KM Chebyshev UCL	107.1
97.5% KM Chebyshev UCL	130.6	99% KM Chebyshev UCL	176.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.166	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.7	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.162	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.073	k star (bias corrected MLE)	2.148
Theta hat (MLE)	15.34	Theta star (bias corrected MLE)	29.1
nu hat (MLE)	48.88	nu star (bias corrected)	25.77
Mean (detects)	62.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	47.73
Maximum	120	Median	42.5
SD	40.03	CV	0.839
k hat (MLE)	0.527	k star (bias corrected MLE)	0.413
Theta hat (MLE)	90.58	Theta star (bias corrected MLE)	115.7
nu hat (MLE)	8.43	nu star (bias corrected)	6.602
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (6.60, α)	1.955	Adjusted Chi Square Value (6.60, β)	1.382
95% Gamma Approximate UCL (use when n>=50)	161.2	95% Gamma Adjusted UCL (use when n<50)	228.1

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	52.56	SD (KM)	32.27
Variance (KM)	1041	SE of Mean (KM)	12.5
k hat (KM)	2.653	k star (KM)	1.741
nu hat (KM)	42.45	nu star (KM)	27.86
theta hat (KM)	19.81	theta star (KM)	30.18
80% gamma percentile (KM)	79.97	90% gamma percentile (KM)	105.6
95% gamma percentile (KM)	130.3	99% gamma percentile (KM)	185.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (27.86, α)	16.82	Adjusted Chi Square Value (27.86, β)	14.69
95% Gamma Approximate KM-UCL (use when n>=50)	87.06	95% Gamma Adjusted KM-UCL (use when n<50)	99.67

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.994	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.125	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	50.85	Mean in Log Scale	3.693
SD in Original Scale	36.31	SD in Log Scale	0.756
95% t UCL (assumes normality of ROS data)	75.18	95% Percentile Bootstrap UCL	71.62
95% BCA Bootstrap UCL	75.13	95% Bootstrap t UCL	84.42
95% H-UCL (Log ROS)	120.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.786	KM Geo Mean	44.09
KM SD (logged)	0.586	95% Critical H Value (KM-Log)	2.507
KM Standard Error of Mean (logged)	0.227	95% H-UCL (KM -Log)	91.16
KM SD (logged)	0.586	95% Critical H Value (KM-Log)	2.507
KM Standard Error of Mean (logged)	0.227		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	50.06	Mean in Log Scale	3.64
SD in Original Scale	37.18	SD in Log Scale	0.832
95% t UCL (Assumes normality)	74.97	95% H-Stat UCL	139.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	76.25

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	19	Minimum Non-Detect	0.71
Maximum Detect	220	Maximum Non-Detect	8
Variance Detects	5376	Percent Non-Detects	25%
Mean Detects	76.5	SD Detects	73.32
Median Detects	59	CV Detects	0.958
Skewness Detects	2.009	Kurtosis Detects	4.426
Mean of Logged Detects	4.021	SD of Logged Detects	0.849

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.756	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.347	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	57.55	KM Standard Error of Mean	25.8
KM SD	66.61	95% KM (BCA) UCL	99.88
95% KM (t) UCL	106.4	95% KM (Percentile Bootstrap) UCL	101
95% KM (z) UCL	99.99	95% KM Bootstrap t UCL	143.3
90% KM Chebyshev UCL	134.9	95% KM Chebyshev UCL	170
97.5% KM Chebyshev UCL	218.7	99% KM Chebyshev UCL	314.2

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.379	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.706	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.249	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.337	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.731	k star (bias corrected MLE)	0.976
Theta hat (MLE)	44.2	Theta star (bias corrected MLE)	78.35
nu hat (MLE)	20.77	nu star (bias corrected)	11.72
Mean (detects)	76.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	57.38
Maximum	220	Median	42.5
SD	71.37	CV	1.244
k hat (MLE)	0.313	k star (bias corrected MLE)	0.279
Theta hat (MLE)	183.1	Theta star (bias corrected MLE)	205.5
nu hat (MLE)	5.014	nu star (bias corrected)	4.467
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (4.47, α)	0.914	Adjusted Chi Square Value (4.47, β)	0.579
95% Gamma Approximate UCL (use when n>=50)	280.3	95% Gamma Adjusted UCL (use when n<50)	442.6

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	57.55	SD (KM)	66.61
Variance (KM)	4437	SE of Mean (KM)	25.8
k hat (KM)	0.747	k star (KM)	0.55
nu hat (KM)	11.95	nu star (KM)	8.799
theta hat (KM)	77.09	theta star (KM)	104.7
80% gamma percentile (KM)	94.8	90% gamma percentile (KM)	152.6
95% gamma percentile (KM)	213.7	99% gamma percentile (KM)	362.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.80, α)	3.206	Adjusted Chi Square Value (8.80, β)	2.414
95% Gamma Approximate KM-UCL (use when n>=50)	158	95% Gamma Adjusted KM-UCL (use when n<50)	209.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	59.04	Mean in Log Scale	3.489
SD in Original Scale	69.9	SD in Log Scale	1.219
95% t UCL (assumes normality of ROS data)	105.9	95% Percentile Bootstrap UCL	100.9
95% BCA Bootstrap UCL	122.3	95% Bootstrap t UCL	160
95% H-UCL (Log ROS)	431.8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.93	KM Geo Mean	18.74
KM SD (logged)	2.005	95% Critical H Value (KM-Log)	6.15
KM Standard Error of Mean (logged)	0.777	95% H-UCL (KM -Log)	14803
KM SD (logged)	2.005	95% Critical H Value (KM-Log)	6.15
KM Standard Error of Mean (logged)	0.777		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	57.92	Mean in Log Scale	3.06
SD in Original Scale	70.88	SD in Log Scale	2.026
95% t UCL (Assumes normality)	105.4	95% H-Stat UCL	19248

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	143.3	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	209.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	3300	Mean	5513
Maximum	11000	Median	4350
SD	2853	Std. Error of Mean	1009
Coefficient of Variation	0.518	Skewness	1.488

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.738	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.389	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7424	95% Adjusted-CLT UCL (Chen-1995)	7739
		95% Modified-t UCL (Johnson-1978)	7512

Gamma GOF Test

A-D Test Statistic	0.933	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.719	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.372	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.424	k star (bias corrected MLE)	3.473
Theta hat (MLE)	1016	Theta star (bias corrected MLE)	1587
nu hat (MLE)	86.78	nu star (bias corrected)	55.57
MLE Mean (bias corrected)	5513	MLE Sd (bias corrected)	2958
		Approximate Chi Square Value (0.05)	39.44
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	36.03

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7767	95% Adjusted Gamma UCL (use when n<50)	8502

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.808	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.347	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.102	Mean of logged Data	8.52
Maximum of Logged Data	9.306	SD of logged Data	0.441

Assuming Lognormal Distribution

95% H-UCL	8044	90% Chebyshev (MVUE) UCL	8022
95% Chebyshev (MVUE) UCL	9186	97.5% Chebyshev (MVUE) UCL	10801
99% Chebyshev (MVUE) UCL	13974		

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	7172	95% Jackknife UCL	7424
95% Standard Bootstrap UCL	7059	95% Bootstrap-t UCL	14514
95% Hall's Bootstrap UCL	21755	95% Percentile Bootstrap UCL	7163
95% BCA Bootstrap UCL	7413		
90% Chebyshev(Mean, Sd) UCL	8539	95% Chebyshev(Mean, Sd) UCL	9910
97.5% Chebyshev(Mean, Sd) UCL	11812	99% Chebyshev(Mean, Sd) UCL	15550

Suggested UCL to Use

95% Student's-t UCL	7424	or 95% Modified-t UCL	7512

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	3.9	Mean	7.613
Maximum	13	Median	6.8
SD	3.027	Std. Error of Mean	1.07
Coefficient of Variation	0.398	Skewness	0.86

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9.64	95% Adjusted-CLT UCL (Chen-1995)	9.72
		95% Modified-t UCL (Johnson-1978)	9.694

Gamma GOF Test

A-D Test Statistic	0.215	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.153	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.656	k star (bias corrected MLE)	4.868
Theta hat (MLE)	0.994	Theta star (bias corrected MLE)	1.564
nu hat (MLE)	122.5	nu star (bias corrected)	77.9
MLE Mean (bias corrected)	7.613	MLE Sd (bias corrected)	3.45
		Approximate Chi Square Value (0.05)	58.56
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	54.34

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	10.13	95% Adjusted Gamma UCL (use when n<50)	10.91

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.128	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.361	Mean of logged Data	1.963
Maximum of Logged Data	2.565	SD of logged Data	0.389

Assuming Lognormal Distribution

95% H-UCL	10.59	90% Chebyshev (MVUE) UCL	10.77
95% Chebyshev (MVUE) UCL	12.2	97.5% Chebyshev (MVUE) UCL	14.19
99% Chebyshev (MVUE) UCL	18.09		

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	9.373	95% Jackknife UCL	9.64
95% Standard Bootstrap UCL	9.287	95% Bootstrap-t UCL	10.91
95% Hall's Bootstrap UCL	15.76	95% Percentile Bootstrap UCL	9.313
95% BCA Bootstrap UCL	9.488		
90% Chebyshev(Mean, Sd) UCL	10.82	95% Chebyshev(Mean, Sd) UCL	12.28
97.5% Chebyshev(Mean, Sd) UCL	14.3	99% Chebyshev(Mean, Sd) UCL	18.26

Suggested UCL to Use

95% Student's-t UCL	9.64

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	6
Number of Detects	2	Number of Non-Detects	6
Number of Distinct Detects	2	Number of Distinct Non-Detects	4
Minimum Detect	0.6	Minimum Non-Detect	0.26
Maximum Detect	3.6	Maximum Non-Detect	1.4
Variance Detects	4.5	Percent Non-Detects	75%
Mean Detects	2.1	SD Detects	2.121
Median Detects	2.1	CV Detects	1.01
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	0.385	SD of Logged Detects	1.267

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.727	KM Standard Error of Mean	0.547
KM SD	1.092	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.763	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.626	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	2.367	95% KM Chebyshev UCL	3.11
97.5% KM Chebyshev UCL	4.141	99% KM Chebyshev UCL	6.167

Gamma GOF Tests on Detected Observations Only

Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.547	k star (bias corrected MLE)	N/A
Theta hat (MLE)	1.358	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	6.186	nu star (bias corrected)	N/A
Mean (detects)	2.1		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.727	SD (KM)	1.092
Variance (KM)	1.193	SE of Mean (KM)	0.547
k hat (KM)	0.443	k star (KM)	0.36
nu hat (KM)	7.089	nu star (KM)	5.764
theta hat (KM)	1.641	theta star (KM)	2.018
80% gamma percentile (KM)	1.157	90% gamma percentile (KM)	2.09
95% gamma percentile (KM)	3.131	99% gamma percentile (KM)	5.779

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0195
Approximate Chi Square Value (5.76, α)	1.521	Adjusted Chi Square Value (5.76, β)	1.037
95% Gamma Approximate KM-UCL (use when n>=50)	2.756	95% Gamma Adjusted KM-UCL (use when n<50)	4.04

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.552	Mean in Log Scale	-2.601
SD in Original Scale	1.247	SD in Log Scale	2.044
95% t UCL (assumes normality of ROS data)	1.388	95% Percentile Bootstrap UCL	1.374
95% BCA Bootstrap UCL	1.885	95% Bootstrap t UCL	25.9
95% H-UCL (Log ROS)	75.45		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.897	KM Geo Mean	0.408
KM SD (logged)	0.873	95% Critical H Value (KM-Log)	3.12
KM Standard Error of Mean (logged)	0.441	95% H-UCL (KM -Log)	1.672
KM SD (logged)	0.873	95% Critical H Value (KM-Log)	3.12
KM Standard Error of Mean (logged)	0.441		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.696	Mean in Log Scale	-1.209
SD in Original Scale	1.197	SD in Log Scale	1.236
95% t UCL (Assumes normality)	1.497	95% H-Stat UCL	4.205

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	3.11

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	3.5	Mean	4.713
Maximum	6.9	Median	4.25
SD	1.324	Std. Error of Mean	0.468
Coefficient of Variation	0.281	Skewness	0.716

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.866	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.255	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.599	95% Adjusted-CLT UCL (Chen-1995)	5.609
		95% Modified-t UCL (Johnson-1978)	5.619

Gamma GOF Test

A-D Test Statistic	0.513	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.267	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	15.38	k star (bias corrected MLE)	9.697
Theta hat (MLE)	0.306	Theta star (bias corrected MLE)	0.486
nu hat (MLE)	246.1	nu star (bias corrected)	155.2
MLE Mean (bias corrected)	4.713	MLE Sd (bias corrected)	1.513
		Approximate Chi Square Value (0.05)	127.4
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	121

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	5.741	95% Adjusted Gamma UCL (use when n<50)	6.043

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.875	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.25	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.253	Mean of logged Data	1.517
Maximum of Logged Data	1.932	SD of logged Data	0.271

Assuming Lognormal Distribution

95% H-UCL	5.817	90% Chebyshev (MVUE) UCL	6.064
95% Chebyshev (MVUE) UCL	6.678	97.5% Chebyshev (MVUE) UCL	7.53
99% Chebyshev (MVUE) UCL	9.204		

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.482	95% Jackknife UCL	5.599
95% Standard Bootstrap UCL	5.449	95% Bootstrap-t UCL	5.837
95% Hall's Bootstrap UCL	5.554	95% Percentile Bootstrap UCL	5.463
95% BCA Bootstrap UCL	5.5		
90% Chebyshev(Mean, Sd) UCL	6.117	95% Chebyshev(Mean, Sd) UCL	6.753
97.5% Chebyshev(Mean, Sd) UCL	7.636	99% Chebyshev(Mean, Sd) UCL	9.37

Suggested UCL to Use

95% Student's-t UCL	5.599

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	8200	Mean	15013
Maximum	25000	Median	14500
SD	5637	Std. Error of Mean	1993
Coefficient of Variation	0.376	Skewness	0.59

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.126	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	18789	95% Adjusted-CLT UCL (Chen-1995)	18735
		95% Modified-t UCL (Johnson-1978)	18858

Gamma GOF Test

A-D Test Statistic	0.168	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.145	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.146	k star (bias corrected MLE)	5.175
Theta hat (MLE)	1843	Theta star (bias corrected MLE)	2901
nu hat (MLE)	130.3	nu star (bias corrected)	82.8
MLE Mean (bias corrected)	15013	MLE Sd (bias corrected)	6599
		Approximate Chi Square Value (0.05)	62.83
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	58.44

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	19784	95% Adjusted Gamma UCL (use when n<50)	21268

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.136	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.012	Mean of logged Data	9.554
Maximum of Logged Data	10.13	SD of logged Data	0.382

Assuming Lognormal Distribution

95% H-UCL	20741	90% Chebyshev (MVUE) UCL	21146
95% Chebyshev (MVUE) UCL	23919	97.5% Chebyshev (MVUE) UCL	27769
99% Chebyshev (MVUE) UCL	35330		

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	18291	95% Jackknife UCL	18789
95% Standard Bootstrap UCL	18057	95% Bootstrap-t UCL	19626
95% Hall's Bootstrap UCL	19922	95% Percentile Bootstrap UCL	18150
95% BCA Bootstrap UCL	18275		
90% Chebyshev(Mean, Sd) UCL	20992	95% Chebyshev(Mean, Sd) UCL	23700
97.5% Chebyshev(Mean, Sd) UCL	27459	99% Chebyshev(Mean, Sd) UCL	34843

Suggested UCL to Use

95% Student's-t UCL	18789

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	8	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	280	Mean	387.5
Maximum	550	Median	390
SD	92.08	Std. Error of Mean	32.55
Coefficient of Variation	0.238	Skewness	0.664

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.922	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.239	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	449.2	95% Adjusted-CLT UCL (Chen-1995)	449.2
		95% Modified-t UCL (Johnson-1978)	450.5

Gamma GOF Test

A-D Test Statistic	0.325	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.209	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	21.02	k star (bias corrected MLE)	13.22
Theta hat (MLE)	18.44	Theta star (bias corrected MLE)	29.31
nu hat (MLE)	336.3	nu star (bias corrected)	211.5
MLE Mean (bias corrected)	387.5	MLE Sd (bias corrected)	106.6
		Approximate Chi Square Value (0.05)	178.9
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	171.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	458.2	95% Adjusted Gamma UCL (use when n<50)	478.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.635	Mean of logged Data	5.936
Maximum of Logged Data	6.31	SD of logged Data	0.233

Assuming Lognormal Distribution

95% H-UCL	462.6	90% Chebyshev (MVUE) UCL	483.3
95% Chebyshev (MVUE) UCL	526.7	97.5% Chebyshev (MVUE) UCL	587
99% Chebyshev (MVUE) UCL	705.4		

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	441	95% Jackknife UCL	449.2
95% Standard Bootstrap UCL	438.3	95% Bootstrap-t UCL	465.7
95% Hall's Bootstrap UCL	501.3	95% Percentile Bootstrap UCL	438.8
95% BCA Bootstrap UCL	441.3		
90% Chebyshev(Mean, Sd) UCL	485.2	95% Chebyshev(Mean, Sd) UCL	529.4
97.5% Chebyshev(Mean, Sd) UCL	590.8	99% Chebyshev(Mean, Sd) UCL	711.4

Suggested UCL to Use

95% Student's-t UCL	449.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	6
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	5	Number of Distinct Non-Detects	1
Minimum Detect	0.12	Minimum Non-Detect	0.095
Maximum Detect	0.24	Maximum Non-Detect	0.095
Variance Detects	0.00186	Percent Non-Detects	12.5%
Mean Detects	0.153	SD Detects	0.0431
Median Detects	0.13	CV Detects	0.282
Skewness Detects	1.669	Kurtosis Detects	2.804
Mean of Logged Detects	-1.908	SD of Logged Detects	0.252

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.796	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.274	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.146	KM Standard Error of Mean	0.016
KM SD	0.0419	95% KM (BCA) UCL	0.173
95% KM (t) UCL	0.176	95% KM (Percentile Bootstrap) UCL	0.17
95% KM (z) UCL	0.172	95% KM Bootstrap t UCL	0.195
90% KM Chebyshev UCL	0.194	95% KM Chebyshev UCL	0.215
97.5% KM Chebyshev UCL	0.246	99% KM Chebyshev UCL	0.305

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.587	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.288	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	17.25	k star (bias corrected MLE)	9.952
Theta hat (MLE)	0.00886	Theta star (bias corrected MLE)	0.0154
nu hat (MLE)	241.5	nu star (bias corrected)	139.3
Mean (detects)	0.153		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0639	Mean	0.142
Maximum	0.24	Median	0.13
SD	0.0508	CV	0.358
k hat (MLE)	8.625	k star (bias corrected MLE)	5.474
Theta hat (MLE)	0.0164	Theta star (bias corrected MLE)	0.0259
nu hat (MLE)	138	nu star (bias corrected)	87.58
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (87.58, α)	67.01	Adjusted Chi Square Value (87.58, β)	62.47
95% Gamma Approximate UCL (use when n>=50)	0.185	95% Gamma Adjusted UCL (use when n<50)	0.199

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.146	SD (KM)	0.0419
Variance (KM)	0.00176	SE of Mean (KM)	0.016
k hat (KM)	12.06	k star (KM)	7.618
nu hat (KM)	192.9	nu star (KM)	121.9
theta hat (KM)	0.0121	theta star (KM)	0.0191
80% gamma percentile (KM)	0.187	90% gamma percentile (KM)	0.216
95% gamma percentile (KM)	0.242	99% gamma percentile (KM)	0.295

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (121.90, α)	97.4	Adjusted Chi Square Value (121.90, β)	91.87
95% Gamma Approximate KM-UCL (use when n>=50)	0.182	95% Gamma Adjusted KM-UCL (use when n<50)	0.193

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.272	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.144	Mean in Log Scale	-1.983
SD in Original Scale	0.0472	SD in Log Scale	0.315
95% t UCL (assumes normality of ROS data)	0.176	95% Percentile Bootstrap UCL	0.171
95% BCA Bootstrap UCL	0.178	95% Bootstrap t UCL	0.188
95% H-UCL (Log ROS)	0.185		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.963	KM Geo Mean	0.14
KM SD (logged)	0.263	95% Critical H Value (KM-Log)	2.013
KM Standard Error of Mean (logged)	0.101	95% H-UCL (KM -Log)	0.178
KM SD (logged)	0.263	95% Critical H Value (KM-Log)	2.013
KM Standard Error of Mean (logged)	0.101		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.14	Mean in Log Scale	-2.05
SD in Original Scale	0.0546	SD in Log Scale	0.465
95% t UCL (Assumes normality)	0.176	95% H-Stat UCL	0.215

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.176

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
Number of Detects	4	Number of Non-Detects	4
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	96	Minimum Non-Detect	24
Maximum Detect	910	Maximum Non-Detect	26
Variance Detects	139731	Percent Non-Detects	50%
Mean Detects	384	SD Detects	373.8
Median Detects	265	CV Detects	0.973
Skewness Detects	1.367	Kurtosis Detects	1.349
Mean of Logged Detects	5.571	SD of Logged Detects	1.018

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.863	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	204	KM Standard Error of Mean	118.9
KM SD	291.2	95% KM (BCA) UCL	N/A
95% KM (t) UCL	429.2	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	399.5	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	560.6	95% KM Chebyshev UCL	722.2
97.5% KM Chebyshev UCL	946.4	99% KM Chebyshev UCL	1387

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.306	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.663	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.4	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.463	k star (bias corrected MLE)	0.532
Theta hat (MLE)	262.5	Theta star (bias corrected MLE)	721.3
nu hat (MLE)	11.7	nu star (bias corrected)	4.259
Mean (detects)	384		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	192
Maximum	910	Median	48.01
SD	319.4	CV	1.663
k hat (MLE)	0.16	k star (bias corrected MLE)	0.183
Theta hat (MLE)	1204	Theta star (bias corrected MLE)	1049
nu hat (MLE)	2.553	nu star (bias corrected)	2.929
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (2.93, α)	0.352	Adjusted Chi Square Value (2.93, β)	0.202
95% Gamma Approximate UCL (use when n>=50)	1599	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.9.2

Summary of ProUCL Output for EU11 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/23/2019 3:59:49 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	204	SD (KM)	291.2
Variance (KM)	84799	SE of Mean (KM)	118.9
k hat (KM)	0.491	k star (KM)	0.39
nu hat (KM)	7.852	nu star (KM)	6.241
theta hat (KM)	415.7	theta star (KM)	523
80% gamma percentile (KM)	328.2	90% gamma percentile (KM)	578.8
95% gamma percentile (KM)	855	99% gamma percentile (KM)	1551

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.24, α)	1.764	Adjusted Chi Square Value (6.24, β)	1.229
95% Gamma Approximate KM-UCL (use when n>=50)	721.7	95% Gamma Adjusted KM-UCL (use when n<50)	1036

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	197.7	Mean in Log Scale	3.959
SD in Original Scale	315.5	SD in Log Scale	1.877
95% t UCL (assumes normality of ROS data)	409.1	95% Percentile Bootstrap UCL	390.6
95% BCA Bootstrap UCL	476.5	95% Bootstrap t UCL	1081
95% H-UCL (Log ROS)	18540		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.375	KM Geo Mean	79.42
KM SD (logged)	1.349	95% Critical H Value (KM-Log)	4.332
KM Standard Error of Mean (logged)	0.551	95% H-UCL (KM -Log)	1798
KM SD (logged)	1.349	95% Critical H Value (KM-Log)	4.332
KM Standard Error of Mean (logged)	0.551		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	198.3	Mean in Log Scale	4.048
SD in Original Scale	315.1	SD in Log Scale	1.759
95% t UCL (Assumes normality)	409.3	95% H-Stat UCL	10158

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	429.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.3

Summary of ProUCL Input Data for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Trichloroethene	D_Trichloroethene	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene
on-site (EU11)	SS-25	11/1/2017	0-2 ft BGS	67	1	25	1	33	1	59	1	29	0	0.71	0
on-site (EU11)	SS-70	10/30/2018	0-2 ft BGS	0.57	0	130	1	120	1	200	1	39	1	28	1
on-site (EU11)	SS-71	10/30/2018	0-2 ft BGS	1.7	1	61	1	80	1	100	1	25	1	19	1
on-site (EU11)	SS-72	10/30/2018	0.5-2.25 ft BGS	0.59	0	400	1	380	1	580	1	62	1	57	1
on-site (EU11)	SS-73	10/30/2018	0.17-2.17 ft BGS	1.7	1	410	1	410	1	570	1	46	1	74	1
on-site (EU11)	SS-74	10/30/2018	0-2 ft BGS	0.6	0	1200	1	1400	1	2000	1	120	1	220	1
on-site (EU11)	SS-75	10/30/2018	0.5-2.5 ft BGS	0.69	0	470	1	440	1	550	1	83	1	61	1
on-site (EU11)	SS-76	10/30/2018	0-2 ft BGS	1.1	1	11	1	11	0	14	1	22	0	8	
on-site (EU11)	SS-77	10/30/2018	0.5-2.5 ft BGS												
on-site (EU11)	SS-165-AS	10/30/2018	0.5-1 ft BGS												
on-site (EU11)	SS-166-AS	10/30/2018	0.5-1 ft BGS												
on-site (EU11)	BH114-18	1/11/2018	3-5 ft BGS	0.45	1	49.5	1	44	1	61	1	30	0	10	1
on-site (EU11)	BH115-18	1/11/2018	3-5 ft BGS	3.5	1	30	1	25	1	48	1	40	0	0.98	0
on-site (EU11)	BH116-18	1/11/2018	11-13 ft BGS	0.39	0	360	1	430	1	620	1	68	0	63	1
on-site (EU11)	TP-13	11/1/2017	8-10 ft BGS	2400	1	37	1	30	1	53	1	30	0	0.73	0
on-site (EU11)	TT-11	10/2/2008	10 ft BGS	5.3	0										
on-site (EU11)	TT-11	10/2/2008	10 ft BGS			760	1	660	1	850	1	78	1	110	1
on-site (EU11)	TT-11	10/2/2008	5 ft BGS	4.4	0							54	0		
on-site (EU11)	TT-11	10/2/2008	5 ft BGS			240	1	270	1	350	1			36	1
on-site (EU11)	TT-12	10/2/2008	10 ft BGS	4.2	0							54	0	7.2	0
on-site (EU11)	TT-12	10/2/2008	10 ft BGS			35	1	36	1	39	1				
on-site (EU11)	TT-12	10/2/2008	5 ft BGS	4.4	0							55	0	7.4	0
on-site (EU11)	TT-12	10/2/2008	5 ft BGS			14	1	13	1	15	1				
on-site (EU11)	BH175-17	12/18/2017	13-15 ft BGS												

Table B.9.3

Summary of ProUCL Input Data for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aluminum	D_Aluminum	Arsenic	D_Arsenic	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron	Manganese	D_Manganese
on-site (EU11)	SS-25	11/1/2017	0-2 ft BGS	3500	1	3.9	1	0.67	1	3.6	1	4.7	1	120	1	15000	1	390	1
on-site (EU11)	SS-70	10/30/2018	0-2 ft BGS	4500	1	6.5	1	0.24	1	0.26	0	3.7	1	19	1	17000	1	390	1
on-site (EU11)	SS-71	10/30/2018	0-2 ft BGS	9000	1	13	1	0.71	1	0.27	0	5.4	1	16	1	14000	1	480	1
on-site (EU11)	SS-72	10/30/2018	0.5-2.25 ft BGS	4200	1	6.1	1	0.35	1	0.26	0	3.5	1	38	1	8900	1	330	1
on-site (EU11)	SS-73	10/30/2018	0.17-2.17 ft BGS	4100	1	5.2	1	1	1	0.28	0	3.5	1	11	1	8200	1	280	1
on-site (EU11)	SS-74	10/30/2018	0-2 ft BGS	3300	1	7.1	1	1	1	0.26	0	3.8	1	39	1	20000	1	390	1
on-site (EU11)	SS-75	10/30/2018	0.5-2.5 ft BGS	11000	1	11	1	0.21	1	1.4	0	6.9	1	85	1	25000	1	290	1
on-site (EU11)	SS-76	10/30/2018	0-2 ft BGS	4500	1	8.1	1	0.61	1	0.6	1	6.2	1	25	1	12000	1	550	1
on-site (EU11)	SS-77	10/30/2018	0.5-2.5 ft BGS																
on-site (EU11)	SS-165-AS	10/30/2018	0.5-1 ft BGS																
on-site (EU11)	SS-166-AS	10/30/2018	0.5-1 ft BGS																
on-site (EU11)	BH114-18	1/11/2018	3-5 ft BGS	4900	1	9.45	1	0.41	1	0.32	1	4.85	1	18.5	1	11150	1	590	1
on-site (EU11)	BH115-18	1/11/2018	3-5 ft BGS	14000	1	45	1	0.31	1	0.69	1	22	1	64	1	8200	1	46	1
on-site (EU11)	BH116-18	1/11/2018	11-13 ft BGS	12000	1	13	1	19	1	1.5	0	6.3	1	410	1	22000	1	420	1
on-site (EU11)	TP-13	11/1/2017	8-10 ft BGS	4000	1	11	1	0.24	1	3.7	1	6.6	1	51	1	21000	1	470	1
on-site (EU11)	TT-11	10/2/2008	10 ft BGS																
on-site (EU11)	TT-11	10/2/2008	10 ft BGS	6450	1	10.6	1	0.74	1	2.7	1	7.4	1	325	1	63700	1	734	1
on-site (EU11)	TT-11	10/2/2008	5 ft BGS					0.54	0										
on-site (EU11)	TT-11	10/2/2008	5 ft BGS	5640	1	5.8	1			1.1	1	3.7	1	12.1	1	10100	1	225	1
on-site (EU11)	TT-12	10/2/2008	10 ft BGS																
on-site (EU11)	TT-12	10/2/2008	10 ft BGS	1980	1	3.9	1	0.099	1	0.55	1	2.3	1	9.4	1	6020	1	164	1
on-site (EU11)	TT-12	10/2/2008	5 ft BGS																
on-site (EU11)	TT-12	10/2/2008	5 ft BGS	5330	1	6	1	0.18	1	1.2	1	4	1	13.8	1	11700	1	271	1
on-site (EU11)	BH175-17	12/18/2017	13-15 ft BGS							1.6	0								

Table B.9.3

Summary of ProUCL Input Data for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				28	29	30	31	32	33	34	35
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Chrysotile asbestos	D_Chrysotile asbestos
on-site (EU11)	SS-25	11/1/2017	0-2 ft BGS	0.12	1	8.6	1	390	1		
on-site (EU11)	SS-70	10/30/2018	0-2 ft BGS	0.13	1	33	1	24	0		
on-site (EU11)	SS-71	10/30/2018	0-2 ft BGS	0.16	1	23	1	25	0		
on-site (EU11)	SS-72	10/30/2018	0.5-2.25 ft BGS	0.12	1	13	1	96	1		
on-site (EU11)	SS-73	10/30/2018	0.17-2.17 ft BGS	0.13	1	12	1	25	0		
on-site (EU11)	SS-74	10/30/2018	0-2 ft BGS	0.095	0	15	1	140	1		
on-site (EU11)	SS-75	10/30/2018	0.5-2.5 ft BGS	0.24	1	28	1	910	1		
on-site (EU11)	SS-76	10/30/2018	0-2 ft BGS	0.17	1	16	1	26	0		
on-site (EU11)	SS-77	10/30/2018	0.5-2.5 ft BGS								
on-site (EU11)	SS-165-AS	10/30/2018	0.5-1 ft BGS								
on-site (EU11)	SS-166-AS	10/30/2018	0.5-1 ft BGS								
on-site (EU11)	BH114-18	1/11/2018	3-5 ft BGS	0.21	1	14	1	25.5	0		
on-site (EU11)	BH115-18	1/11/2018	3-5 ft BGS	1.4	1	72	1	34	0		
on-site (EU11)	BH116-18	1/11/2018	11-13 ft BGS	0.26	1	18	1	29	0	2	1
on-site (EU11)	TP-13	11/1/2017	8-10 ft BGS	0.39	1	14	1	33	1		
on-site (EU11)	TT-11	10/2/2008	10 ft BGS	0.17	0			20	1		
on-site (EU11)	TT-11	10/2/2008	10 ft BGS			36.2	1				
on-site (EU11)	TT-11	10/2/2008	5 ft BGS	0.15	0			36	0		
on-site (EU11)	TT-11	10/2/2008	5 ft BGS			14.3	1				
on-site (EU11)	TT-12	10/2/2008	10 ft BGS	0.11	0			36	0		
on-site (EU11)	TT-12	10/2/2008	10 ft BGS			6.4	1				
on-site (EU11)	TT-12	10/2/2008	5 ft BGS	0.17	0			37	0		
on-site (EU11)	TT-12	10/2/2008	5 ft BGS			14	1				
on-site (EU11)	BH175-17	12/18/2017	13-15 ft BGS								

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	16	Number of Distinct Observations	14
		Number of Missing Observations	6
Number of Detects	7	Number of Non-Detects	9
Number of Distinct Detects	6	Number of Distinct Non-Detects	8
Minimum Detect	0.45	Minimum Non-Detect	0.39
Maximum Detect	2400	Maximum Non-Detect	5.3
Variance Detects	814850	Percent Non-Detects	56.25%
Mean Detects	353.6	SD Detects	902.7
Median Detects	1.7	CV Detects	2.553
Skewness Detects	2.642	Kurtosis Detects	6.984
Mean of Logged Detects	1.943	SD of Logged Detects	3.017

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.47	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.482	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	155.1	KM Standard Error of Mean	156.6
KM SD	579.8	95% KM (BCA) UCL	455
95% KM (t) UCL	429.6	95% KM (Percentile Bootstrap) UCL	454.7
95% KM (z) UCL	412.7	95% KM Bootstrap t UCL	79352
90% KM Chebyshev UCL	624.8	95% KM Chebyshev UCL	837.6
97.5% KM Chebyshev UCL	1133	99% KM Chebyshev UCL	1713

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.144	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.832	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.383	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.344	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.189	k star (bias corrected MLE)	0.203
Theta hat (MLE)	1870	Theta star (bias corrected MLE)	1740
nu hat (MLE)	2.647	nu star (bias corrected)	2.846
Mean (detects)	353.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	154.7
Maximum	2400	Median	0.01
SD	599	CV	3.871
k hat (MLE)	0.117	k star (bias corrected MLE)	0.137
Theta hat (MLE)	1319	Theta star (bias corrected MLE)	1130
nu hat (MLE)	3.753	nu star (bias corrected)	4.383
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (4.38, α)	0.879	Adjusted Chi Square Value (4.38, β)	0.718
95% Gamma Approximate UCL (use when n>=50)	771.9	95% Gamma Adjusted UCL (use when n<50)	943.9

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	155.1	SD (KM)	579.8
Variance (KM)	336224	SE of Mean (KM)	156.6
k hat (KM)	0.0716	k star (KM)	0.0998
nu hat (KM)	2.29	nu star (KM)	3.194
theta hat (KM)	2168	theta star (KM)	1554
80% gamma percentile (KM)	107.3	90% gamma percentile (KM)	412.5
95% gamma percentile (KM)	900.4	99% gamma percentile (KM)	2466

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.19, α)	0.432	Adjusted Chi Square Value (3.19, β)	0.339
95% Gamma Approximate KM-UCL (use when n>=50)	1147	95% Gamma Adjusted KM-UCL (use when n<50)	1459

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.821	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.305	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	154.8	Mean in Log Scale	-0.818
SD in Original Scale	598.9	SD in Log Scale	3.363
95% t UCL (assumes normality of ROS data)	417.3	95% Percentile Bootstrap UCL	454.6
95% BCA Bootstrap UCL	604.9	95% Bootstrap t UCL	98437
95% H-UCL (Log ROS)	62659		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.503	KM Geo Mean	1.654
KM SD (logged)	2.286	95% Critical H Value (KM-Log)	5.018
KM Standard Error of Mean (logged)	0.63	95% H-UCL (KM -Log)	435.9
KM SD (logged)	2.286	95% Critical H Value (KM-Log)	5.018
KM Standard Error of Mean (logged)	0.63		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	155.4	Mean in Log Scale	0.657
SD in Original Scale	598.8	SD in Log Scale	2.383
95% t UCL (Assumes normality)	417.8	95% H-Stat UCL	812.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	1713

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	7
Minimum	11	Mean	264.5
Maximum	1200	Median	95.5
SD	332.8	Std. Error of Mean	83.21
Coefficient of Variation	1.258	Skewness	1.761

Normal GOF Test

Shapiro Wilk Test Statistic	0.769	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	410.4	95% Adjusted-CLT UCL (Chen-1995)	440.5
		95% Modified-t UCL (Johnson-1978)	416.5

Gamma GOF Test

A-D Test Statistic	0.581	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.781	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.224	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.679	k star (bias corrected MLE)	0.594
Theta hat (MLE)	389.4	Theta star (bias corrected MLE)	445.6
nu hat (MLE)	21.74	nu star (bias corrected)	19
MLE Mean (bias corrected)	264.5	MLE Sd (bias corrected)	343.3
		Approximate Chi Square Value (0.05)	10.11
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	9.383

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	496.8	95% Adjusted Gamma UCL (use when n<50)	535.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.163	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.398	Mean of logged Data	4.685
Maximum of Logged Data	7.09	SD of logged Data	1.504

Assuming Lognormal Distribution

95% H-UCL	1330	90% Chebyshev (MVUE) UCL	678.6
95% Chebyshev (MVUE) UCL	852.4	97.5% Chebyshev (MVUE) UCL	1094
99% Chebyshev (MVUE) UCL	1568		

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	401.4	95% Jackknife UCL	410.4
95% Standard Bootstrap UCL	401	95% Bootstrap-t UCL	520.4
95% Hall's Bootstrap UCL	603.1	95% Percentile Bootstrap UCL	407.9
95% BCA Bootstrap UCL	448.4		
90% Chebyshev(Mean, Sd) UCL	514.2	95% Chebyshev(Mean, Sd) UCL	627.2
97.5% Chebyshev(Mean, Sd) UCL	784.2	99% Chebyshev(Mean, Sd) UCL	1092

Suggested UCL to Use

95% Adjusted Gamma UCL	535.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	7
Number of Detects	15	Number of Non-Detects	1
Number of Distinct Detects	15	Number of Distinct Non-Detects	1
Minimum Detect	13	Minimum Non-Detect	11
Maximum Detect	1400	Maximum Non-Detect	11
Variance Detects	136615	Percent Non-Detects	6.25%
Mean Detects	291.4	SD Detects	369.6
Median Detects	120	CV Detects	1.268
Skewness Detects	2.12	Kurtosis Detects	5.422
Mean of Logged Detects	4.844	SD of Logged Detects	1.447

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.74	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.226	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	273.9	KM Standard Error of Mean	91.18
KM SD	352.3	95% KM (BCA) UCL	443.1
95% KM (t) UCL	433.7	95% KM (Percentile Bootstrap) UCL	435.9
95% KM (z) UCL	423.8	95% KM Bootstrap t UCL	542
90% KM Chebyshev UCL	547.4	95% KM Chebyshev UCL	671.3
97.5% KM Chebyshev UCL	843.3	99% KM Chebyshev UCL	1181

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.574	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.777	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.231	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.724	k star (bias corrected MLE)	0.624
Theta hat (MLE)	402.4	Theta star (bias corrected MLE)	467.2
nu hat (MLE)	21.72	nu star (bias corrected)	18.71
Mean (detects)	291.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	273.2
Maximum	1400	Median	100
SD	364.4	CV	1.334
k hat (MLE)	0.472	k star (bias corrected MLE)	0.425
Theta hat (MLE)	578.4	Theta star (bias corrected MLE)	642.1
nu hat (MLE)	15.12	nu star (bias corrected)	13.61
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (13.61, α)	6.308	Adjusted Chi Square Value (13.61, β)	5.75
95% Gamma Approximate UCL (use when n>=50)	589.6	95% Gamma Adjusted UCL (use when n<50)	646.8

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	273.9	SD (KM)	352.3
Variance (KM)	124145	SE of Mean (KM)	91.18
k hat (KM)	0.604	k star (KM)	0.533
nu hat (KM)	19.33	nu star (KM)	17.04
theta hat (KM)	453.3	theta star (KM)	514.2
80% gamma percentile (KM)	450.8	90% gamma percentile (KM)	731.2
95% gamma percentile (KM)	1029	99% gamma percentile (KM)	1756

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.04, α)	8.703	Adjusted Chi Square Value (17.04, β)	8.031
95% Gamma Approximate KM-UCL (use when n>=50)	536.3	95% Gamma Adjusted KM-UCL (use when n<50)	581.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	273.4	Mean in Log Scale	4.624
SD in Original Scale	364.2	SD in Log Scale	1.651
95% t UCL (assumes normality of ROS data)	433.1	95% Percentile Bootstrap UCL	435.9
95% BCA Bootstrap UCL	476	95% Bootstrap t UCL	537.7
95% H-UCL (Log ROS)	2028		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.691	KM Geo Mean	109
KM SD (logged)	1.477	95% Critical H Value (KM-Log)	3.504
KM Standard Error of Mean (logged)	0.382	95% H-UCL (KM -Log)	1235
KM SD (logged)	1.477	95% Critical H Value (KM-Log)	3.504
KM Standard Error of Mean (logged)	0.382		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	273.5	Mean in Log Scale	4.648
SD in Original Scale	364.2	SD in Log Scale	1.603
95% t UCL (Assumes normality)	433.1	95% H-Stat UCL	1767

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	581.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	7
Minimum	14	Mean	381.8
Maximum	2000	Median	150
SD	511.5	Std. Error of Mean	127.9
Coefficient of Variation	1.34	Skewness	2.314

Normal GOF Test

Shapiro Wilk Test Statistic	0.712	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	606	95% Adjusted-CLT UCL (Chen-1995)	671.2
		95% Modified-t UCL (Johnson-1978)	618.3

Gamma GOF Test

A-D Test Statistic	0.569	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.782	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.2	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.224	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.67	k star (bias corrected MLE)	0.586
Theta hat (MLE)	569.9	Theta star (bias corrected MLE)	651.6
nu hat (MLE)	21.44	nu star (bias corrected)	18.75
MLE Mean (bias corrected)	381.8	MLE Sd (bias corrected)	498.8
		Approximate Chi Square Value (0.05)	9.937
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	9.212

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	720.5	95% Adjusted Gamma UCL (use when n<50)	777.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.173	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.639	Mean of logged Data	5.037
Maximum of Logged Data	7.601	SD of logged Data	1.523

Assuming Lognormal Distribution

95% H-UCL	2011	90% Chebyshev (MVUE) UCL	997.4
95% Chebyshev (MVUE) UCL	1254	97.5% Chebyshev (MVUE) UCL	1611
99% Chebyshev (MVUE) UCL	2312		

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	592.2	95% Jackknife UCL	606
95% Standard Bootstrap UCL	578.1	95% Bootstrap-t UCL	764.1
95% Hall's Bootstrap UCL	1481	95% Percentile Bootstrap UCL	608.9
95% BCA Bootstrap UCL	690.3		
90% Chebyshev(Mean, Sd) UCL	765.5	95% Chebyshev(Mean, Sd) UCL	939.2
97.5% Chebyshev(Mean, Sd) UCL	1180	99% Chebyshev(Mean, Sd) UCL	1654

Suggested UCL to Use

95% Adjusted Gamma UCL	777.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	16	Number of Distinct Observations	14
		Number of Missing Observations	6
Number of Detects	7	Number of Non-Detects	9
Number of Distinct Detects	7	Number of Distinct Non-Detects	7
Minimum Detect	25	Minimum Non-Detect	22
Maximum Detect	120	Maximum Non-Detect	68
Variance Detects	1027	Percent Non-Detects	56.25%
Mean Detects	64.71	SD Detects	32.05
Median Detects	62	CV Detects	0.495
Skewness Detects	0.647	Kurtosis Detects	0.143
Mean of Logged Detects	4.057	SD of Logged Detects	0.527

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.149	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	43.04	KM Standard Error of Mean	7.749
KM SD	27.96	95% KM (BCA) UCL	57.23
95% KM (t) UCL	56.63	95% KM (Percentile Bootstrap) UCL	55.68
95% KM (z) UCL	55.79	95% KM Bootstrap t UCL	58.75
90% KM Chebyshev UCL	66.29	95% KM Chebyshev UCL	76.82
97.5% KM Chebyshev UCL	91.44	99% KM Chebyshev UCL	120.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.16	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.143	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.598	k star (bias corrected MLE)	2.723
Theta hat (MLE)	14.07	Theta star (bias corrected MLE)	23.77
nu hat (MLE)	64.38	nu star (bias corrected)	38.12
Mean (detects)	64.71		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	35
Maximum	120	Median	22.51
SD	34.52	CV	0.986
k hat (MLE)	0.518	k star (bias corrected MLE)	0.463
Theta hat (MLE)	67.55	Theta star (bias corrected MLE)	75.65
nu hat (MLE)	16.58	nu star (bias corrected)	14.81
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (14.81, α)	7.128	Adjusted Chi Square Value (14.81, β)	6.529
95% Gamma Approximate UCL (use when n>=50)	72.72	95% Gamma Adjusted UCL (use when n<50)	79.39

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	43.04	SD (KM)	27.96
Variance (KM)	781.9	SE of Mean (KM)	7.749
k hat (KM)	2.369	k star (KM)	1.967
nu hat (KM)	75.82	nu star (KM)	62.94
theta hat (KM)	18.17	theta star (KM)	21.88
80% gamma percentile (KM)	64.57	90% gamma percentile (KM)	84.04
95% gamma percentile (KM)	102.6	99% gamma percentile (KM)	143.9

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (62.94, α)	45.69	Adjusted Chi Square Value (62.94, β)	44.02
95% Gamma Approximate KM-UCL (use when n>=50)	59.29	95% Gamma Adjusted KM-UCL (use when n<50)	61.54

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.983	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	40.27	Mean in Log Scale	3.476
SD in Original Scale	30.39	SD in Log Scale	0.657
95% t UCL (assumes normality of ROS data)	53.59	95% Percentile Bootstrap UCL	53.28
95% BCA Bootstrap UCL	55.85	95% Bootstrap t UCL	61.05
95% H-UCL (Log ROS)	58.54		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.595	KM Geo Mean	36.41
KM SD (logged)	0.547	95% Critical H Value (KM-Log)	2.1
KM Standard Error of Mean (logged)	0.158	95% H-UCL (KM -Log)	56.92
KM SD (logged)	0.547	95% Critical H Value (KM-Log)	2.1
KM Standard Error of Mean (logged)	0.158		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	40.25	Mean in Log Scale	3.457
SD in Original Scale	30.67	SD in Log Scale	0.699
95% t UCL (Assumes normality)	53.69	95% H-Stat UCL	61.16

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	56.63

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	6
Number of Detects	10	Number of Non-Detects	6
Number of Distinct Detects	10	Number of Distinct Non-Detects	6
Minimum Detect	10	Minimum Non-Detect	0.71
Maximum Detect	220	Maximum Non-Detect	8
Variance Detects	3721	Percent Non-Detects	37.5%
Mean Detects	67.8	SD Detects	61
Median Detects	59	CV Detects	0.9
Skewness Detects	1.955	Kurtosis Detects	4.491
Mean of Logged Detects	3.886	SD of Logged Detects	0.885

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	42.64	KM Standard Error of Mean	14.79
KM SD	56.11	95% KM (BCA) UCL	67.19
95% KM (t) UCL	68.56	95% KM (Percentile Bootstrap) UCL	67.02
95% KM (z) UCL	66.96	95% KM Bootstrap t UCL	83
90% KM Chebyshev UCL	87	95% KM Chebyshev UCL	107.1
97.5% KM Chebyshev UCL	135	99% KM Chebyshev UCL	189.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.227	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.738	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.154	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.271	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.659	k star (bias corrected MLE)	1.228
Theta hat (MLE)	40.87	Theta star (bias corrected MLE)	55.22
nu hat (MLE)	33.17	nu star (bias corrected)	24.56
Mean (detects)	67.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	42.38
Maximum	220	Median	23.5
SD	58.15	CV	1.372
k hat (MLE)	0.236	k star (bias corrected MLE)	0.233
Theta hat (MLE)	179.9	Theta star (bias corrected MLE)	181.9
nu hat (MLE)	7.536	nu star (bias corrected)	7.457
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (7.46, α)	2.425	Adjusted Chi Square Value (7.46, β)	2.111
95% Gamma Approximate UCL (use when n>=50)	130.3	95% Gamma Adjusted UCL (use when n<50)	149.7

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	42.64	SD (KM)	56.11
Variance (KM)	3148	SE of Mean (KM)	14.79
k hat (KM)	0.578	k star (KM)	0.511
nu hat (KM)	18.48	nu star (KM)	16.35
theta hat (KM)	73.82	theta star (KM)	83.45
80% gamma percentile (KM)	70.09	90% gamma percentile (KM)	114.8
95% gamma percentile (KM)	162.5	99% gamma percentile (KM)	279.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.35, α)	8.211	Adjusted Chi Square Value (16.35, β)	7.561
95% Gamma Approximate KM-UCL (use when n>=50)	84.92	95% Gamma Adjusted KM-UCL (use when n<50)	92.22

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.983	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	44.4	Mean in Log Scale	3.062
SD in Original Scale	56.62	SD in Log Scale	1.295
95% t UCL (assumes normality of ROS data)	69.22	95% Percentile Bootstrap UCL	69.28
95% BCA Bootstrap UCL	76.83	95% Bootstrap t UCL	89.69
95% H-UCL (Log ROS)	143.4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.3	KM Geo Mean	9.976
KM SD (logged)	2.152	95% Critical H Value (KM-Log)	4.76
KM Standard Error of Mean (logged)	0.567	95% H-UCL (KM -Log)	1422
KM SD (logged)	2.152	95% Critical H Value (KM-Log)	4.76
KM Standard Error of Mean (logged)	0.567		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	43.16	Mean in Log Scale	2.505
SD in Original Scale	57.56	SD in Log Scale	2.09
95% t UCL (Assumes normality)	68.38	95% H-Stat UCL	1331

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	68.56

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	16	Number of Distinct Observations	15
		Number of Missing Observations	7
Minimum	1980	Mean	6150
Maximum	14000	Median	4700
SD	3471	Std. Error of Mean	867.7
Coefficient of Variation	0.564	Skewness	1.22

Normal GOF Test

Shapiro Wilk Test Statistic	0.843	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7671	95% Adjusted-CLT UCL (Chen-1995)	7860
		95% Modified-t UCL (Johnson-1978)	7715

Gamma GOF Test

A-D Test Statistic	0.671	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.187	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.937	k star (bias corrected MLE)	3.241
Theta hat (MLE)	1562	Theta star (bias corrected MLE)	1898
nu hat (MLE)	126	nu star (bias corrected)	103.7
MLE Mean (bias corrected)	6150	MLE Sd (bias corrected)	3416
		Approximate Chi Square Value (0.05)	81.21
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	78.94

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	7854	95% Adjusted Gamma UCL (use when n<50)	8079

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.153	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.591	Mean of logged Data	8.592
Maximum of Logged Data	9.547	SD of logged Data	0.522

Assuming Lognormal Distribution

95% H-UCL	8165	90% Chebyshev (MVUE) UCL	8593
95% Chebyshev (MVUE) UCL	9714	97.5% Chebyshev (MVUE) UCL	11271
99% Chebyshev (MVUE) UCL	14330		

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7577	95% Jackknife UCL	7671
95% Standard Bootstrap UCL	7506	95% Bootstrap-t UCL	8210
95% Hall's Bootstrap UCL	7768	95% Percentile Bootstrap UCL	7628
95% BCA Bootstrap UCL	7717		
90% Chebyshev(Mean, Sd) UCL	8753	95% Chebyshev(Mean, Sd) UCL	9932
97.5% Chebyshev(Mean, Sd) UCL	11569	99% Chebyshev(Mean, Sd) UCL	14783

Suggested UCL to Use

95% Adjusted Gamma UCL	8079

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	16	Number of Distinct Observations	13
		Number of Missing Observations	7
Minimum	3.9	Mean	10.35
Maximum	45	Median	7.6
SD	9.71	Std. Error of Mean	2.427
Coefficient of Variation	0.938	Skewness	3.379

Normal GOF Test

Shapiro Wilk Test Statistic	0.559	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.33	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	14.61	95% Adjusted-CLT UCL (Chen-1995)	16.54
		95% Modified-t UCL (Johnson-1978)	14.95

Gamma GOF Test

A-D Test Statistic	1.041	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.217	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.503	k star (bias corrected MLE)	2.076
Theta hat (MLE)	4.135	Theta star (bias corrected MLE)	4.988
nu hat (MLE)	80.11	nu star (bias corrected)	66.42
MLE Mean (bias corrected)	10.35	MLE Sd (bias corrected)	7.186
		Approximate Chi Square Value (0.05)	48.67
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	46.94

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	14.13	95% Adjusted Gamma UCL (use when n<50)	14.65

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.361	Mean of logged Data	2.124
Maximum of Logged Data	3.807	SD of logged Data	0.593

Assuming Lognormal Distribution

95% H-UCL	13.86	90% Chebyshev (MVUE) UCL	14.42
95% Chebyshev (MVUE) UCL	16.48	97.5% Chebyshev (MVUE) UCL	19.35
99% Chebyshev (MVUE) UCL	24.99		

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	14.35	95% Jackknife UCL	14.61
95% Standard Bootstrap UCL	14.17	95% Bootstrap-t UCL	21.78
95% Hall's Bootstrap UCL	29.85	95% Percentile Bootstrap UCL	14.75
95% BCA Bootstrap UCL	17.34		
90% Chebyshev(Mean, Sd) UCL	17.64	95% Chebyshev(Mean, Sd) UCL	20.93
97.5% Chebyshev(Mean, Sd) UCL	25.51	99% Chebyshev(Mean, Sd) UCL	34.51

Suggested UCL to Use

95% H-UCL	13.86

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	16	Number of Distinct Observations	14
		Number of Missing Observations	7
Number of Detects	15	Number of Non-Detects	1
Number of Distinct Detects	13	Number of Distinct Non-Detects	1
Minimum Detect	0.099	Minimum Non-Detect	0.54
Maximum Detect	19	Maximum Non-Detect	0.54
Variance Detects	22.94	Percent Non-Detects	6.25%
Mean Detects	1.718	SD Detects	4.79
Median Detects	0.41	CV Detects	2.788
Skewness Detects	3.848	Kurtosis Detects	14.86
Mean of Logged Detects	-0.677	SD of Logged Detects	1.21

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.337	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.493	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.626	KM Standard Error of Mean	1.163
KM SD	4.494	95% KM (BCA) UCL	3.986
95% KM (t) UCL	3.665	95% KM (Percentile Bootstrap) UCL	3.949
95% KM (z) UCL	3.54	95% KM Bootstrap t UCL	25.53
90% KM Chebyshev UCL	5.116	95% KM Chebyshev UCL	6.696
97.5% KM Chebyshev UCL	8.89	99% KM Chebyshev UCL	13.2

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.469	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.792	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.385	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.234	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.519	k star (bias corrected MLE)	0.459
Theta hat (MLE)	3.312	Theta star (bias corrected MLE)	3.74
nu hat (MLE)	15.56	nu star (bias corrected)	13.78
Mean (detects)	1.718		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.611
Maximum	19	Median	0.38
SD	4.647	CV	2.884
k hat (MLE)	0.46	k star (bias corrected MLE)	0.415
Theta hat (MLE)	3.503	Theta star (bias corrected MLE)	3.879
nu hat (MLE)	14.72	nu star (bias corrected)	13.29
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (13.29, α)	6.09	Adjusted Chi Square Value (13.29, β)	5.543
95% Gamma Approximate UCL (use when n>=50)	3.517	95% Gamma Adjusted UCL (use when n<50)	3.864

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.626	SD (KM)	4.494
Variance (KM)	20.2	SE of Mean (KM)	1.163
k hat (KM)	0.131	k star (KM)	0.148
nu hat (KM)	4.191	nu star (KM)	4.738
theta hat (KM)	12.42	theta star (KM)	10.98
80% gamma percentile (KM)	1.752	90% gamma percentile (KM)	4.814
95% gamma percentile (KM)	8.974	99% gamma percentile (KM)	21.08

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.74, α)	1.033	Adjusted Chi Square Value (4.74, β)	0.854
95% Gamma Approximate KM-UCL (use when n>=50)	7.459	95% Gamma Adjusted KM-UCL (use when n<50)	9.026

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.826	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.626	Mean in Log Scale	-0.723
SD in Original Scale	4.642	SD in Log Scale	1.183
95% t UCL (assumes normality of ROS data)	3.66	95% Percentile Bootstrap UCL	3.953
95% BCA Bootstrap UCL	5.128	95% Bootstrap t UCL	24.94
95% H-UCL (Log ROS)	2.441		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.725	KM Geo Mean	0.485
KM SD (logged)	1.151	95% Critical H Value (KM-Log)	2.944
KM Standard Error of Mean (logged)	0.299	95% H-UCL (KM -Log)	2.255
KM SD (logged)	1.151	95% Critical H Value (KM-Log)	2.944
KM Standard Error of Mean (logged)	0.299		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.627	Mean in Log Scale	-0.716
SD in Original Scale	4.642	SD in Log Scale	1.179
95% t UCL (Assumes normality)	3.662	95% H-Stat UCL	2.434

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	6.696

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	17	Number of Distinct Observations	15
		Number of Missing Observations	7
Number of Detects	9	Number of Non-Detects	8
Number of Distinct Detects	9	Number of Distinct Non-Detects	6
Minimum Detect	0.32	Minimum Non-Detect	0.26
Maximum Detect	3.7	Maximum Non-Detect	1.6
Variance Detects	1.825	Percent Non-Detects	47.06%
Mean Detects	1.607	SD Detects	1.351
Median Detects	1.1	CV Detects	0.841
Skewness Detects	0.854	Kurtosis Detects	-1.174
Mean of Logged Detects	0.138	SD of Logged Detects	0.885

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.812	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.019	KM Standard Error of Mean	0.293
KM SD	1.129	95% KM (BCA) UCL	1.534
95% KM (t) UCL	1.531	95% KM (Percentile Bootstrap) UCL	1.517
95% KM (z) UCL	1.502	95% KM Bootstrap t UCL	1.784
90% KM Chebyshev UCL	1.899	95% KM Chebyshev UCL	2.297
97.5% KM Chebyshev UCL	2.85	99% KM Chebyshev UCL	3.936

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.501	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.201	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.284	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.634	k star (bias corrected MLE)	1.163
Theta hat (MLE)	0.983	Theta star (bias corrected MLE)	1.381
nu hat (MLE)	29.41	nu star (bias corrected)	20.94
Mean (detects)	1.607		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.871
Maximum	3.7	Median	0.32
SD	1.249	CV	1.434
k hat (MLE)	0.421	k star (bias corrected MLE)	0.386
Theta hat (MLE)	2.07	Theta star (bias corrected MLE)	2.258
nu hat (MLE)	14.31	nu star (bias corrected)	13.12
Adjusted Level of Significance (β)	0.0346		
Approximate Chi Square Value (13.12, α)	5.972	Adjusted Chi Square Value (13.12, β)	5.473
95% Gamma Approximate UCL (use when n>=50)	1.913	95% Gamma Adjusted UCL (use when n<50)	2.088

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.019	SD (KM)	1.129
Variance (KM)	1.274	SE of Mean (KM)	0.293
k hat (KM)	0.816	k star (KM)	0.711
nu hat (KM)	27.74	nu star (KM)	24.18
theta hat (KM)	1.249	theta star (KM)	1.434
80% gamma percentile (KM)	1.675	90% gamma percentile (KM)	2.55
95% gamma percentile (KM)	3.45	99% gamma percentile (KM)	5.598

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.18, α)	13.99	Adjusted Chi Square Value (24.18, β)	13.18
95% Gamma Approximate KM-UCL (use when n>=50)	1.763	95% Gamma Adjusted KM-UCL (use when n<50)	1.871

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.956	Mean in Log Scale	-0.692
SD in Original Scale	1.194	SD in Log Scale	1.163
95% t UCL (assumes normality of ROS data)	1.461	95% Percentile Bootstrap UCL	1.457
95% BCA Bootstrap UCL	1.565	95% Bootstrap t UCL	1.835
95% H-UCL (Log ROS)	2.298		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.469	KM Geo Mean	0.626
KM SD (logged)	0.934	95% Critical H Value (KM-Log)	2.574
KM Standard Error of Mean (logged)	0.25	95% H-UCL (KM -Log)	1.765
KM SD (logged)	0.934	95% Critical H Value (KM-Log)	2.574
KM Standard Error of Mean (logged)	0.25		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.022	Mean in Log Scale	-0.572
SD in Original Scale	1.169	SD in Log Scale	1.159
95% t UCL (Assumes normality)	1.517	95% H-Stat UCL	2.574

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	1.871	95% GROS Adjusted Gamma UCL	2.088

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	16	Number of Distinct Observations	14
		Number of Missing Observations	7
Minimum	2.3	Mean	5.928
Maximum	22	Median	4.775
SD	4.533	Std. Error of Mean	1.133
Coefficient of Variation	0.765	Skewness	3.303

Normal GOF Test

Shapiro Wilk Test Statistic	0.58	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.31	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7.915	95% Adjusted-CLT UCL (Chen-1995)	8.792
		95% Modified-t UCL (Johnson-1978)	8.071

Gamma GOF Test

A-D Test Statistic	1.127	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.743	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.21	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.478	k star (bias corrected MLE)	2.867
Theta hat (MLE)	1.705	Theta star (bias corrected MLE)	2.068
nu hat (MLE)	111.3	nu star (bias corrected)	91.75
MLE Mean (bias corrected)	5.928	MLE Sd (bias corrected)	3.501
		Approximate Chi Square Value (0.05)	70.66
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	68.56

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	7.697	95% Adjusted Gamma UCL (use when n<50)	7.934

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.167	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.833	Mean of logged Data	1.629
Maximum of Logged Data	3.091	SD of logged Data	0.503

Assuming Lognormal Distribution

95% H-UCL	7.557	90% Chebyshev (MVUE) UCL	7.971
95% Chebyshev (MVUE) UCL	8.983	97.5% Chebyshev (MVUE) UCL	10.39
99% Chebyshev (MVUE) UCL	13.15		

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7.792	95% Jackknife UCL	7.915
95% Standard Bootstrap UCL	7.763	95% Bootstrap-t UCL	10.74
95% Hall's Bootstrap UCL	15.11	95% Percentile Bootstrap UCL	7.981
95% BCA Bootstrap UCL	9.181		
90% Chebyshev(Mean, Sd) UCL	9.328	95% Chebyshev(Mean, Sd) UCL	10.87
97.5% Chebyshev(Mean, Sd) UCL	13	99% Chebyshev(Mean, Sd) UCL	17.2

Suggested UCL to Use

95% Adjusted Gamma UCL	7.934

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	7
Minimum	9.4	Mean	78.55
Maximum	410	Median	31.5
SD	117.9	Std. Error of Mean	29.47
Coefficient of Variation	1.501	Skewness	2.292

Normal GOF Test

Shapiro Wilk Test Statistic	0.617	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	130.2	95% Adjusted-CLT UCL (Chen-1995)	145.1
		95% Modified-t UCL (Johnson-1978)	133

Gamma GOF Test

A-D Test Statistic	1.082	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.772	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.193	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.223	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.805	k star (bias corrected MLE)	0.696
Theta hat (MLE)	97.59	Theta star (bias corrected MLE)	112.9
nu hat (MLE)	25.76	nu star (bias corrected)	22.26
MLE Mean (bias corrected)	78.55	MLE Sd (bias corrected)	94.18
		Approximate Chi Square Value (0.05)	12.53
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	11.71

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	139.5	95% Adjusted Gamma UCL (use when n<50)	149.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.159	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.241	Mean of logged Data	3.627
Maximum of Logged Data	6.016	SD of logged Data	1.164

Assuming Lognormal Distribution

95% H-UCL	180.6	90% Chebyshev (MVUE) UCL	137.4
95% Chebyshev (MVUE) UCL	168.2	97.5% Chebyshev (MVUE) UCL	210.9
99% Chebyshev (MVUE) UCL	294.8		

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	127	95% Jackknife UCL	130.2
95% Standard Bootstrap UCL	126.8	95% Bootstrap-t UCL	252.2
95% Hall's Bootstrap UCL	354.8	95% Percentile Bootstrap UCL	129.8
95% BCA Bootstrap UCL	142		
90% Chebyshev(Mean, Sd) UCL	167	95% Chebyshev(Mean, Sd) UCL	207
97.5% Chebyshev(Mean, Sd) UCL	262.6	99% Chebyshev(Mean, Sd) UCL	371.8

Suggested UCL to Use

95% Adjusted Gamma UCL	149.3

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	16	Number of Distinct Observations	15
		Number of Missing Observations	7
Minimum	6020	Mean	17123
Maximum	63700	Median	13000
SD	13623	Std. Error of Mean	3406
Coefficient of Variation	0.796	Skewness	2.938

Normal GOF Test

Shapiro Wilk Test Statistic	0.657	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.235	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	23093	95% Adjusted-CLT UCL (Chen-1995)	25398
		95% Modified-t UCL (Johnson-1978)	23510

Gamma GOF Test

A-D Test Statistic	0.667	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.145	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.217	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.91	k star (bias corrected MLE)	2.406
Theta hat (MLE)	5883	Theta star (bias corrected MLE)	7116
nu hat (MLE)	93.14	nu star (bias corrected)	77.01
MLE Mean (bias corrected)	17123	MLE Sd (bias corrected)	11038
		Approximate Chi Square Value (0.05)	57.79
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	55.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	22816	95% Adjusted Gamma UCL (use when n<50)	23589

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.12	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.703	Mean of logged Data	9.567
Maximum of Logged Data	11.06	SD of logged Data	0.57

Assuming Lognormal Distribution

95% H-UCL	22960	90% Chebyshev (MVUE) UCL	23983
95% Chebyshev (MVUE) UCL	27325	97.5% Chebyshev (MVUE) UCL	31964
99% Chebyshev (MVUE) UCL	41076		

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	22725	95% Jackknife UCL	23093
95% Standard Bootstrap UCL	22451	95% Bootstrap-t UCL	29807
95% Hall's Bootstrap UCL	45599	95% Percentile Bootstrap UCL	22900
95% BCA Bootstrap UCL	26319		
90% Chebyshev(Mean, Sd) UCL	27340	95% Chebyshev(Mean, Sd) UCL	31968
97.5% Chebyshev(Mean, Sd) UCL	38391	99% Chebyshev(Mean, Sd) UCL	51009

Suggested UCL to Use

95% Adjusted Gamma UCL	23589

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	16	Number of Distinct Observations	14
		Number of Missing Observations	7
Minimum	46	Mean	376.3
Maximum	734	Median	390
SD	169.9	Std. Error of Mean	42.47
Coefficient of Variation	0.451	Skewness	0.171

Normal GOF Test

Shapiro Wilk Test Statistic	0.99	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.0948	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	450.7	95% Adjusted-CLT UCL (Chen-1995)	448
		95% Modified-t UCL (Johnson-1978)	451

Gamma GOF Test

A-D Test Statistic	0.437	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.159	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.216	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.667	k star (bias corrected MLE)	3.021
Theta hat (MLE)	102.6	Theta star (bias corrected MLE)	124.5
nu hat (MLE)	117.4	nu star (bias corrected)	96.69
MLE Mean (bias corrected)	376.3	MLE Sd (bias corrected)	216.5
		Approximate Chi Square Value (0.05)	75
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	72.83

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	485	95% Adjusted Gamma UCL (use when n<50)	499.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.833	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.199	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.829	Mean of logged Data	5.788
Maximum of Logged Data	6.599	SD of logged Data	0.645

Assuming Lognormal Distribution

95% H-UCL	580.9	90% Chebyshev (MVUE) UCL	596.7
95% Chebyshev (MVUE) UCL	687.8	97.5% Chebyshev (MVUE) UCL	814.1
99% Chebyshev (MVUE) UCL	1062		

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	446.1	95% Jackknife UCL	450.7
95% Standard Bootstrap UCL	443.4	95% Bootstrap-t UCL	451.7
95% Hall's Bootstrap UCL	455.4	95% Percentile Bootstrap UCL	444.8
95% BCA Bootstrap UCL	444.3		
90% Chebyshev(Mean, Sd) UCL	503.6	95% Chebyshev(Mean, Sd) UCL	561.4
97.5% Chebyshev(Mean, Sd) UCL	641.5	99% Chebyshev(Mean, Sd) UCL	798.8

Suggested UCL to Use

95% Student's-t UCL	450.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	16	Number of Distinct Observations	12
		Number of Missing Observations	6
Number of Detects	11	Number of Non-Detects	5
Number of Distinct Detects	9	Number of Distinct Non-Detects	4
Minimum Detect	0.12	Minimum Non-Detect	0.095
Maximum Detect	1.4	Maximum Non-Detect	0.17
Variance Detects	0.139	Percent Non-Detects	31.25%
Mean Detects	0.303	SD Detects	0.373
Median Detects	0.17	CV Detects	1.232
Skewness Detects	3.048	Kurtosis Detects	9.627
Mean of Logged Detects	-1.533	SD of Logged Detects	0.724

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.526	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.364	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.242	KM Standard Error of Mean	0.0809
KM SD	0.308	95% KM (BCA) UCL	0.404
95% KM (t) UCL	0.384	95% KM (Percentile Bootstrap) UCL	0.392
95% KM (z) UCL	0.375	95% KM Bootstrap t UCL	0.835
90% KM Chebyshev UCL	0.485	95% KM Chebyshev UCL	0.595
97.5% KM Chebyshev UCL	0.747	99% KM Chebyshev UCL	1.047

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.336	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.741	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.287	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.259	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.625	k star (bias corrected MLE)	1.242
Theta hat (MLE)	0.186	Theta star (bias corrected MLE)	0.244
nu hat (MLE)	35.74	nu star (bias corrected)	27.33
Mean (detects)	0.303		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.214
Maximum	1.4	Median	0.13
SD	0.334	CV	1.561
k hat (MLE)	0.71	k star (bias corrected MLE)	0.619
Theta hat (MLE)	0.301	Theta star (bias corrected MLE)	0.345
nu hat (MLE)	22.73	nu star (bias corrected)	19.8
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (19.80, α)	10.71	Adjusted Chi Square Value (19.80, β)	9.95
95% Gamma Approximate UCL (use when n>=50)	0.395	95% Gamma Adjusted UCL (use when n<50)	0.425

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.242	SD (KM)	0.308
Variance (KM)	0.0951	SE of Mean (KM)	0.0809
k hat (KM)	0.617	k star (KM)	0.543
nu hat (KM)	19.76	nu star (KM)	17.39
theta hat (KM)	0.392	theta star (KM)	0.446
80% gamma percentile (KM)	0.399	90% gamma percentile (KM)	0.644
95% gamma percentile (KM)	0.903	99% gamma percentile (KM)	1.536

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.39, α)	8.95	Adjusted Chi Square Value (17.39, β)	8.267
95% Gamma Approximate KM-UCL (use when n>=50)	0.471	95% Gamma Adjusted KM-UCL (use when n<50)	0.51

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.232	Mean in Log Scale	-1.884
SD in Original Scale	0.324	SD in Log Scale	0.829
95% t UCL (assumes normality of ROS data)	0.374	95% Percentile Bootstrap UCL	0.385
95% BCA Bootstrap UCL	0.481	95% Bootstrap t UCL	0.76
95% H-UCL (Log ROS)	0.362		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.75	KM Geo Mean	0.174
KM SD (logged)	0.663	95% Critical H Value (KM-Log)	2.234
KM Standard Error of Mean (logged)	0.175	95% H-UCL (KM -Log)	0.317
KM SD (logged)	0.663	95% Critical H Value (KM-Log)	2.234
KM Standard Error of Mean (logged)	0.175		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.23	Mean in Log Scale	-1.896
SD in Original Scale	0.324	SD in Log Scale	0.823
95% t UCL (Assumes normality)	0.372	95% H-Stat UCL	0.354

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.317

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	16	Number of Distinct Observations	14
		Number of Missing Observations	7
Minimum	6.4	Mean	21.09
Maximum	72	Median	14.65
SD	15.92	Std. Error of Mean	3.981
Coefficient of Variation	0.755	Skewness	2.439

Normal GOF Test

Shapiro Wilk Test Statistic	0.719	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.265	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	28.07	95% Adjusted-CLT UCL (Chen-1995)	30.23
		95% Modified-t UCL (Johnson-1978)	28.48

Gamma GOF Test

A-D Test Statistic	0.815	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.222	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.217	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.87	k star (bias corrected MLE)	2.374
Theta hat (MLE)	7.349	Theta star (bias corrected MLE)	8.887
nu hat (MLE)	91.84	nu star (bias corrected)	75.96
MLE Mean (bias corrected)	21.09	MLE Sd (bias corrected)	13.69
		Approximate Chi Square Value (0.05)	56.88
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	55.01

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	28.17	95% Adjusted Gamma UCL (use when n<50)	29.13

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.937	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.856	Mean of logged Data	2.865
Maximum of Logged Data	4.277	SD of logged Data	0.589

Assuming Lognormal Distribution

95% H-UCL	28.91	90% Chebyshev (MVUE) UCL	30.09
95% Chebyshev (MVUE) UCL	34.39	97.5% Chebyshev (MVUE) UCL	40.35
99% Chebyshev (MVUE) UCL	52.06		

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	27.64	95% Jackknife UCL	28.07
95% Standard Bootstrap UCL	27.58	95% Bootstrap-t UCL	34.65
95% Hall's Bootstrap UCL	53.62	95% Percentile Bootstrap UCL	28.15
95% BCA Bootstrap UCL	30.63		
90% Chebyshev(Mean, Sd) UCL	33.04	95% Chebyshev(Mean, Sd) UCL	38.44
97.5% Chebyshev(Mean, Sd) UCL	45.95	99% Chebyshev(Mean, Sd) UCL	60.7

Suggested UCL to Use

95% H-UCL 28.91

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	16	Number of Distinct Observations	14
		Number of Missing Observations	6
Number of Detects	6	Number of Non-Detects	10
Number of Distinct Detects	6	Number of Distinct Non-Detects	8
Minimum Detect	20	Minimum Non-Detect	24
Maximum Detect	910	Maximum Non-Detect	37
Variance Detects	117937	Percent Non-Detects	62.5%
Mean Detects	264.8	SD Detects	343.4
Median Detects	118	CV Detects	1.297
Skewness Detects	1.753	Kurtosis Detects	2.861
Mean of Logged Detects	4.796	SD of Logged Detects	1.445

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.776	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.309	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	112.2	KM Standard Error of Mean	61.75
KM SD	225.5	95% KM (BCA) UCL	227.5
95% KM (t) UCL	220.5	95% KM (Percentile Bootstrap) UCL	215.6
95% KM (z) UCL	213.8	95% KM Bootstrap t UCL	552.9
90% KM Chebyshev UCL	297.5	95% KM Chebyshev UCL	381.4
97.5% KM Chebyshev UCL	497.9	99% KM Chebyshev UCL	726.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.27	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.208	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.343	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.763	k star (bias corrected MLE)	0.493
Theta hat (MLE)	347.1	Theta star (bias corrected MLE)	537.6
nu hat (MLE)	9.156	nu star (bias corrected)	5.911
Mean (detects)	264.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	99.32
Maximum	910	Median	0.01
SD	238.4	CV	2.401
k hat (MLE)	0.137	k star (bias corrected MLE)	0.153
Theta hat (MLE)	724.3	Theta star (bias corrected MLE)	648.8
nu hat (MLE)	4.388	nu star (bias corrected)	4.898
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (4.90, α)	1.106	Adjusted Chi Square Value (4.90, β)	0.917
95% Gamma Approximate UCL (use when n>=50)	440.1	95% Gamma Adjusted UCL (use when n<50)	530.2

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	112.2	SD (KM)	225.5
Variance (KM)	50835	SE of Mean (KM)	61.75
k hat (KM)	0.248	k star (KM)	0.243
nu hat (KM)	7.927	nu star (KM)	7.774
theta hat (KM)	453	theta star (KM)	461.9
80% gamma percentile (KM)	161.3	90% gamma percentile (KM)	337.5
95% gamma percentile (KM)	547.8	99% gamma percentile (KM)	1110

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.77, α)	2.605	Adjusted Chi Square Value (7.77, β)	2.277
95% Gamma Approximate KM-UCL (use when n>=50)	334.9	95% Gamma Adjusted KM-UCL (use when n<50)	383.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.149	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	107.8	Mean in Log Scale	3.38
SD in Original Scale	234.8	SD in Log Scale	1.444
95% t UCL (assumes normality of ROS data)	210.7	95% Percentile Bootstrap UCL	209.7
95% BCA Bootstrap UCL	272.6	95% Bootstrap t UCL	617.3
95% H-UCL (Log ROS)	301		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.687	KM Geo Mean	39.91
KM SD (logged)	1.183	95% Critical H Value (KM-Log)	2.996
KM Standard Error of Mean (logged)	0.325	95% H-UCL (KM -Log)	200.6
KM SD (logged)	1.183	95% Critical H Value (KM-Log)	2.996
KM Standard Error of Mean (logged)	0.325		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	108.6	Mean in Log Scale	3.477
SD in Original Scale	234.4	SD in Log Scale	1.353
95% t UCL (Assumes normality)	211.3	95% H-Stat UCL	254.3

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	220.5

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.9.4

Summary of ProUCL Output for EU11 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 4:12:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysotile asbestos

General Statistics

Total Number of Observations	1	Number of Distinct Observations	1
		Number of Missing Observations	13
Minimum	2	Mean	2
Maximum	2	Median	2

Warning: This data set only has 1 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Chrysotile asbestos was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Table B.10.1

Summary of ProUCL Input Data for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)pyrene	D_Benzo(a)pyrene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Aluminum	D_Aluminum	Arsenic	D_Arsenic	Cobalt	D_Cobalt
on-site (EU12)	SS-62	10/30/2018	0.17-2.17 ft BGS	750	1	51	1	130	1	4600	1	6.2	1	4.9	1
on-site (EU12)	SS-63	10/30/2018	0.17-2.17 ft BGS	11	0	23	0	8.3	0	2000	1	2.4	1	2.8	1
on-site (EU12)	SS-64	10/30/2018	0-2 ft BGS	37	1	32	1	17	1	840	1	5.5	1	6.4	1
on-site (EU12)	SS-65	10/30/2018	0.25-2.25 ft BGS	202	1	90	1	56	1	3400	1	27.95	1	5.25	1
on-site (EU12)	SS-66	10/30/2018	0.17-2.17 ft BGS	99	1	21	0	19	1	3400	1	5	1	3.7	1
on-site (EU12)	SS-67	10/30/2018	0.17-2.17 ft BGS	78	1	22	0	13	1	7900	1	9.4	1	7.1	1
on-site (EU12)	SS-68	10/30/2018	0.17-2.17 ft BGS	27	1	21	0	7.7	0	5400	1	8.6	1	4	1
on-site (EU12)	SS-69	10/30/2018	0.33-2.33 ft BGS	53	0	110	0	39	0	1400	1	1.7	1	0.76	1
on-site (EU12)	SS-89	10/30/2018	0-2 ft BGS												
on-site (EU12)	SS-167-AS	10/30/2018	0-0.5 ft BGS												

Table B.10.1

Summary of ProUCL Input Data for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU12)	SS-62	10/30/2018	0.17-2.17 ft BGS	9300	1	230	1	0.17	1	14	1	210	1
on-site (EU12)	SS-63	10/30/2018	0.17-2.17 ft BGS	4800	1	110	1	0.052	0	12	1	27	0
on-site (EU12)	SS-64	10/30/2018	0-2 ft BGS	5500	1	15	1	0.086	0	12	1	25	0
on-site (EU12)	SS-65	10/30/2018	0.25-2.25 ft BGS	5500	1	128.5	1	0.485	1	31	1	30	0
on-site (EU12)	SS-66	10/30/2018	0.17-2.17 ft BGS	9900	1	400	1	0.14	1	11	1	25	0
on-site (EU12)	SS-67	10/30/2018	0.17-2.17 ft BGS	12000	1	390	1	0.27	1	22	1	27	0
on-site (EU12)	SS-68	10/30/2018	0.17-2.17 ft BGS	10000	1	410	1	0.15	1	13	1	25	0
on-site (EU12)	SS-69	10/30/2018	0.33-2.33 ft BGS	10000	1	100	1	0.044	0	1.6	1	26	0
on-site (EU12)	SS-89	10/30/2018	0-2 ft BGS										
on-site (EU12)	SS-167-AS	10/30/2018	0-0.5 ft BGS										

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	27	Minimum Non-Detect	11
Maximum Detect	750	Maximum Non-Detect	53
Variance Detects	76816	Percent Non-Detects	25%
Mean Detects	198.8	SD Detects	277.2
Median Detects	88.5	CV Detects	1.394
Skewness Detects	2.189	Kurtosis Detects	4.92
Mean of Logged Detects	4.631	SD of Logged Detects	1.21

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.685	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.329	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	153.6	KM Standard Error of Mean	90.16
KM SD	232.7	95% KM (BCA) UCL	318.5
95% KM (t) UCL	324.4	95% KM (Percentile Bootstrap) UCL	316
95% KM (z) UCL	301.9	95% KM Bootstrap t UCL	906.6
90% KM Chebyshev UCL	424.1	95% KM Chebyshev UCL	546.6
97.5% KM Chebyshev UCL	716.6	99% KM Chebyshev UCL	1051

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.432	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.252	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.342	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.886	k star (bias corrected MLE)	0.554
Theta hat (MLE)	224.5	Theta star (bias corrected MLE)	358.9
nu hat (MLE)	10.63	nu star (bias corrected)	6.648
Mean (detects)	198.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	149.1
Maximum	750	Median	57.5
SD	251.7	CV	1.688
k hat (MLE)	0.263	k star (bias corrected MLE)	0.247
Theta hat (MLE)	567.8	Theta star (bias corrected MLE)	602.5
nu hat (MLE)	4.203	nu star (bias corrected)	3.96
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (3.96, α)	0.706	Adjusted Chi Square Value (3.96, β)	0.431
95% Gamma Approximate UCL (use when n>=50)	836.5	95% Gamma Adjusted UCL (use when n<50)	1370

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	153.6	SD (KM)	232.7
Variance (KM)	54168	SE of Mean (KM)	90.16
k hat (KM)	0.436	k star (KM)	0.356
nu hat (KM)	6.971	nu star (KM)	5.69
theta hat (KM)	352.6	theta star (KM)	432
80% gamma percentile (KM)	243.9	90% gamma percentile (KM)	442.5
95% gamma percentile (KM)	664.4	99% gamma percentile (KM)	1230

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.69, α)	1.484	Adjusted Chi Square Value (5.69, β)	1.009
95% Gamma Approximate KM-UCL (use when n>=50)	589.2	95% Gamma Adjusted KM-UCL (use when n<50)	866.7

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.179	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	152.1	Mean in Log Scale	4.054
SD in Original Scale	249.7	SD in Log Scale	1.513
95% t UCL (assumes normality of ROS data)	319.4	95% Percentile Bootstrap UCL	314.7
95% BCA Bootstrap UCL	401.3	95% Bootstrap t UCL	921.5
95% H-UCL (Log ROS)	2781		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.161	KM Geo Mean	64.12
KM SD (logged)	1.281	95% Critical H Value (KM-Log)	4.151
KM Standard Error of Mean (logged)	0.503	95% H-UCL (KM -Log)	1088
KM SD (logged)	1.281	95% Critical H Value (KM-Log)	4.151
KM Standard Error of Mean (logged)	0.503		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	153.1	Mean in Log Scale	4.096
SD in Original Scale	249.1	SD in Log Scale	1.484
95% t UCL (Assumes normality)	320	95% H-Stat UCL	2523

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	906.6	Gamma Adjusted KM-UCL (use if k<=1 and 15 <n<50 but k<=1)	866.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
Number of Detects	3	Number of Non-Detects	5
Number of Distinct Detects	3	Number of Distinct Non-Detects	4
Minimum Detect	32	Minimum Non-Detect	21
Maximum Detect	90	Maximum Non-Detect	110
Variance Detects	874.3	Percent Non-Detects	62.5%
Mean Detects	57.67	SD Detects	29.57
Median Detects	51	CV Detects	0.513
Skewness Detects	0.963	Kurtosis Detects	N/A
Mean of Logged Detects	3.966	SD of Logged Detects	0.518

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	36.71	KM Standard Error of Mean	11.14
KM SD	24.06	95% KM (BCA) UCL	N/A
95% KM (t) UCL	57.82	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	55.04	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	70.13	95% KM Chebyshev UCL	85.27
97.5% KM Chebyshev UCL	106.3	99% KM Chebyshev UCL	147.5

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	5.787	k star (bias corrected MLE)	N/A
Theta hat (MLE)	9.966	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	34.72	nu star (bias corrected)	N/A
Mean (detects)	57.67		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	21.72
Maximum	90	Median	0.357
SD	33.7	CV	1.552
k hat (MLE)	0.189	k star (bias corrected MLE)	0.201
Theta hat (MLE)	115.1	Theta star (bias corrected MLE)	107.9
nu hat (MLE)	3.018	nu star (bias corrected)	3.219
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (3.22, α)	0.44	Adjusted Chi Square Value (3.22, β)	0.255
95% Gamma Approximate UCL (use when n>=50)	158.8	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	36.71	SD (KM)	24.06
Variance (KM)	579.1	SE of Mean (KM)	11.14
k hat (KM)	2.328	k star (KM)	1.538
nu hat (KM)	37.24	nu star (KM)	24.61
theta hat (KM)	15.77	theta star (KM)	23.87
80% gamma percentile (KM)	56.65	90% gamma percentile (KM)	76.04
95% gamma percentile (KM)	94.84	99% gamma percentile (KM)	137.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (24.61, α)	14.31	Adjusted Chi Square Value (24.61, β)	12.37
95% Gamma Approximate KM-UCL (use when n>=50)	63.12	95% Gamma Adjusted KM-UCL (use when n<50)	73.03

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.997	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	28.03	Mean in Log Scale	2.894
SD in Original Scale	29.4	SD in Log Scale	0.986
95% t UCL (assumes normality of ROS data)	47.72	95% Percentile Bootstrap UCL	44.34
95% BCA Bootstrap UCL	52.6	95% Bootstrap t UCL	77.35
95% H-UCL (Log ROS)	104.1		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.439	KM Geo Mean	31.17
KM SD (logged)	0.533	95% Critical H Value (KM-Log)	2.412
KM Standard Error of Mean (logged)	0.247	95% H-UCL (KM -Log)	58.43
KM SD (logged)	0.533	95% Critical H Value (KM-Log)	2.412
KM Standard Error of Mean (logged)	0.247		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	33.94	Mean in Log Scale	3.181
SD in Original Scale	29.3	SD in Log Scale	0.895
95% t UCL (Assumes normality)	53.56	95% H-Stat UCL	104.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	57.82

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	5	Number of Non-Detects	3
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	13	Minimum Non-Detect	7.7
Maximum Detect	130	Maximum Non-Detect	39
Variance Detects	2453	Percent Non-Detects	37.5%
Mean Detects	47	SD Detects	49.52
Median Detects	19	CV Detects	1.054
Skewness Detects	1.661	Kurtosis Detects	2.438
Mean of Logged Detects	3.447	SD of Logged Detects	0.97

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.775	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.314	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	32.91	KM Standard Error of Mean	15.64
KM SD	39.52	95% KM (BCA) UCL	57.71
95% KM (t) UCL	62.54	95% KM (Percentile Bootstrap) UCL	58.54
95% KM (z) UCL	58.63	95% KM Bootstrap t UCL	187.4
90% KM Chebyshev UCL	79.83	95% KM Chebyshev UCL	101.1
97.5% KM Chebyshev UCL	130.6	99% KM Chebyshev UCL	188.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.496	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.688	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.334	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.362	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.384	k star (bias corrected MLE)	0.687
Theta hat (MLE)	33.97	Theta star (bias corrected MLE)	68.44
nu hat (MLE)	13.84	nu star (bias corrected)	6.867
Mean (detects)	47		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	29.38
Maximum	130	Median	15
SD	44.64	CV	1.52
k hat (MLE)	0.242	k star (bias corrected MLE)	0.234
Theta hat (MLE)	121.5	Theta star (bias corrected MLE)	125.3
nu hat (MLE)	3.869	nu star (bias corrected)	3.752
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (3.75, α)	0.626	Adjusted Chi Square Value (3.75, β)	0.376
95% Gamma Approximate UCL (use when n>=50)	176	95% Gamma Adjusted UCL (use when n<50)	292.8

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	32.91	SD (KM)	39.52
Variance (KM)	1562	SE of Mean (KM)	15.64
k hat (KM)	0.693	k star (KM)	0.517
nu hat (KM)	11.09	nu star (KM)	8.267
theta hat (KM)	47.46	theta star (KM)	63.7
80% gamma percentile (KM)	54.12	90% gamma percentile (KM)	88.43
95% gamma percentile (KM)	125	99% gamma percentile (KM)	214.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.27, α)	2.891	Adjusted Chi Square Value (8.27, β)	2.149
95% Gamma Approximate KM-UCL (use when n>=50)	94.12	95% Gamma Adjusted KM-UCL (use when n<50)	126.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.298	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	31.4	Mean in Log Scale	2.739
SD in Original Scale	43.23	SD in Log Scale	1.263
95% t UCL (assumes normality of ROS data)	60.36	95% Percentile Bootstrap UCL	57.17
95% BCA Bootstrap UCL	67.42	95% Bootstrap t UCL	177.6
95% H-UCL (Log ROS)	243.5		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.975	KM Geo Mean	19.6
KM SD (logged)	0.936	95% Critical H Value (KM-Log)	3.269
KM Standard Error of Mean (logged)	0.374	95% H-UCL (KM -Log)	96.49
KM SD (logged)	0.936	95% Critical H Value (KM-Log)	3.269
KM Standard Error of Mean (logged)	0.374		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	32.81	Mean in Log Scale	2.872
SD in Original Scale	42.52	SD in Log Scale	1.186
95% t UCL (Assumes normality)	61.29	95% H-Stat UCL	204.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	62.54

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	840	Mean	3618
Maximum	7900	Median	3400
SD	2325	Std. Error of Mean	821.9
Coefficient of Variation	0.643	Skewness	0.736

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5175	95% Adjusted-CLT UCL (Chen-1995)	5198
		95% Modified-t UCL (Johnson-1978)	5210

Gamma GOF Test

A-D Test Statistic	0.179	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.723	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.171	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.501	k star (bias corrected MLE)	1.647
Theta hat (MLE)	1446	Theta star (bias corrected MLE)	2197
nu hat (MLE)	40.02	nu star (bias corrected)	26.35
MLE Mean (bias corrected)	3618	MLE Sd (bias corrected)	2819
		Approximate Chi Square Value (0.05)	15.65
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	13.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6091	95% Adjusted Gamma UCL (use when n<50)	7006

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.733	Mean of logged Data	7.981
Maximum of Logged Data	8.975	SD of logged Data	0.742

Assuming Lognormal Distribution

95% H-UCL	8507	90% Chebyshev (MVUE) UCL	6660
95% Chebyshev (MVUE) UCL	8001	97.5% Chebyshev (MVUE) UCL	9864
99% Chebyshev (MVUE) UCL	13521		

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4969	95% Jackknife UCL	5175
95% Standard Bootstrap UCL	4878	95% Bootstrap-t UCL	5541
95% Hall's Bootstrap UCL	5724	95% Percentile Bootstrap UCL	4888
95% BCA Bootstrap UCL	5168		
90% Chebyshev(Mean, Sd) UCL	6083	95% Chebyshev(Mean, Sd) UCL	7200
97.5% Chebyshev(Mean, Sd) UCL	8750	99% Chebyshev(Mean, Sd) UCL	11795

Suggested UCL to Use

95% Student's-t UCL	5175

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	1.7	Mean	8.344
Maximum	27.95	Median	5.85
SD	8.357	Std. Error of Mean	2.955
Coefficient of Variation	1.002	Skewness	2.273

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.72	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.325	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	13.94	95% Adjusted-CLT UCL (Chen-1995)	15.74
		95% Modified-t UCL (Johnson-1978)	14.34

Gamma GOF Test

A-D Test Statistic	0.387	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.626	k star (bias corrected MLE)	1.099
Theta hat (MLE)	5.132	Theta star (bias corrected MLE)	7.589
nu hat (MLE)	26.01	nu star (bias corrected)	17.59
MLE Mean (bias corrected)	8.344	MLE Sd (bias corrected)	7.958
		Approximate Chi Square Value (0.05)	9.096
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	7.602

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	16.14	95% Adjusted Gamma UCL (use when n<50)	19.31

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.531	Mean of logged Data	1.783
Maximum of Logged Data	3.33	SD of logged Data	0.859

Assuming Lognormal Distribution

95% H-UCL	23.47	90% Chebyshev (MVUE) UCL	15.69
95% Chebyshev (MVUE) UCL	19.12	97.5% Chebyshev (MVUE) UCL	23.87
99% Chebyshev (MVUE) UCL	33.2		

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13.2	95% Jackknife UCL	13.94
95% Standard Bootstrap UCL	12.88	95% Bootstrap-t UCL	20.93
95% Hall's Bootstrap UCL	33.71	95% Percentile Bootstrap UCL	13.91
95% BCA Bootstrap UCL	15.71		
90% Chebyshev(Mean, Sd) UCL	17.21	95% Chebyshev(Mean, Sd) UCL	21.22
97.5% Chebyshev(Mean, Sd) UCL	26.8	99% Chebyshev(Mean, Sd) UCL	37.74

Suggested UCL to Use

95% Adjusted Gamma UCL	19.31

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	0.76	Mean	4.364
Maximum	7.1	Median	4.45
SD	2.025	Std. Error of Mean	0.716
Coefficient of Variation	0.464	Skewness	-0.486

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.122	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.72	95% Adjusted-CLT UCL (Chen-1995)	5.41
		95% Modified-t UCL (Johnson-1978)	5.7

Gamma GOF Test

A-D Test Statistic	0.448	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.208	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.3	k star (bias corrected MLE)	2.146
Theta hat (MLE)	1.323	Theta star (bias corrected MLE)	2.034
nu hat (MLE)	52.79	nu star (bias corrected)	34.33
MLE Mean (bias corrected)	4.364	MLE Sd (bias corrected)	2.979
		Approximate Chi Square Value (0.05)	21.93
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	19.46

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.832	95% Adjusted Gamma UCL (use when n<50)	7.698

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.809	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.274	Mean of logged Data	1.314
Maximum of Logged Data	1.96	SD of logged Data	0.709

Assuming Lognormal Distribution

95% H-UCL	10	90% Chebyshev (MVUE) UCL	8.137
95% Chebyshev (MVUE) UCL	9.733	97.5% Chebyshev (MVUE) UCL	11.95
99% Chebyshev (MVUE) UCL	16.3		

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.542	95% Jackknife UCL	5.72
95% Standard Bootstrap UCL	5.456	95% Bootstrap-t UCL	5.576
95% Hall's Bootstrap UCL	5.521	95% Percentile Bootstrap UCL	5.419
95% BCA Bootstrap UCL	5.433		
90% Chebyshev(Mean, Sd) UCL	6.512	95% Chebyshev(Mean, Sd) UCL	7.485
97.5% Chebyshev(Mean, Sd) UCL	8.835	99% Chebyshev(Mean, Sd) UCL	11.49

Suggested UCL to Use

95% Student's-t UCL	5.72

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	8	Number of Distinct Observations	6
		Number of Missing Observations	0
Minimum	4800	Mean	8375
Maximum	12000	Median	9600
SD	2697	Std. Error of Mean	953.5
Coefficient of Variation	0.322	Skewness	-0.317

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.855	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.259	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	10182	95% Adjusted-CLT UCL (Chen-1995)	9829
		95% Modified-t UCL (Johnson-1978)	10164

Gamma GOF Test

A-D Test Statistic	0.774	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.715	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.295	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.294	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.89	k star (bias corrected MLE)	6.264
Theta hat (MLE)	846.8	Theta star (bias corrected MLE)	1337
nu hat (MLE)	158.2	nu star (bias corrected)	100.2
MLE Mean (bias corrected)	8375	MLE Sd (bias corrected)	3346
		Approximate Chi Square Value (0.05)	78.13
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	73.21

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	10744	95% Adjusted Gamma UCL (use when n<50)	11466

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.83	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.296	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.476	Mean of logged Data	8.982
Maximum of Logged Data	9.393	SD of logged Data	0.353

Assuming Lognormal Distribution

95% H-UCL	11250	90% Chebyshev (MVUE) UCL	11563
95% Chebyshev (MVUE) UCL	12997	97.5% Chebyshev (MVUE) UCL	14986
99% Chebyshev (MVUE) UCL	18894		

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	9943	95% Jackknife UCL	10182
95% Standard Bootstrap UCL	9839	95% Bootstrap-t UCL	10026
95% Hall's Bootstrap UCL	9674	95% Percentile Bootstrap UCL	9863
95% BCA Bootstrap UCL	9725		
90% Chebyshev(Mean, Sd) UCL	11236	95% Chebyshev(Mean, Sd) UCL	12531
97.5% Chebyshev(Mean, Sd) UCL	14330	99% Chebyshev(Mean, Sd) UCL	17862

Suggested UCL to Use

95% Student's-t UCL	10182

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	15	Mean	222.9
Maximum	410	Median	179.3
SD	157.8	Std. Error of Mean	55.79
Coefficient of Variation	0.708	Skewness	0.176

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.866	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	328.6	95% Adjusted-CLT UCL (Chen-1995)	318.4
		95% Modified-t UCL (Johnson-1978)	329.2

Gamma GOF Test

A-D Test Statistic	0.447	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.49	k star (bias corrected MLE)	1.015
Theta hat (MLE)	149.6	Theta star (bias corrected MLE)	219.7
nu hat (MLE)	23.84	nu star (bias corrected)	16.23
MLE Mean (bias corrected)	222.9	MLE Sd (bias corrected)	221.3
		Approximate Chi Square Value (0.05)	8.126
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	6.728

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	445.3	95% Adjusted Gamma UCL (use when n<50)	537.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.708	Mean of logged Data	5.035
Maximum of Logged Data	6.016	SD of logged Data	1.112

Assuming Lognormal Distribution

95% H-UCL	1353	90% Chebyshev (MVUE) UCL	565.1
95% Chebyshev (MVUE) UCL	704.9	97.5% Chebyshev (MVUE) UCL	899
99% Chebyshev (MVUE) UCL	1280		

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	314.7	95% Jackknife UCL	328.6
95% Standard Bootstrap UCL	309.6	95% Bootstrap-t UCL	331.4
95% Hall's Bootstrap UCL	293.5	95% Percentile Bootstrap UCL	309.4
95% BCA Bootstrap UCL	310.6		
90% Chebyshev(Mean, Sd) UCL	390.3	95% Chebyshev(Mean, Sd) UCL	466.1
97.5% Chebyshev(Mean, Sd) UCL	571.4	99% Chebyshev(Mean, Sd) UCL	778.1

Suggested UCL to Use

95% Student's-t UCL	328.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
Number of Detects	5	Number of Non-Detects	3
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	0.14	Minimum Non-Detect	0.044
Maximum Detect	0.485	Maximum Non-Detect	0.086
Variance Detects	0.021	Percent Non-Detects	37.5%
Mean Detects	0.243	SD Detects	0.145
Median Detects	0.17	CV Detects	0.596
Skewness Detects	1.634	Kurtosis Detects	2.364
Mean of Logged Detects	-1.534	SD of Logged Detects	0.52

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.795	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.293	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.168	KM Standard Error of Mean	0.0556
KM SD	0.141	95% KM (BCA) UCL	0.276
95% KM (t) UCL	0.274	95% KM (Percentile Bootstrap) UCL	0.254
95% KM (z) UCL	0.26	95% KM Bootstrap t UCL	0.309
90% KM Chebyshev UCL	0.335	95% KM Chebyshev UCL	0.411
97.5% KM Chebyshev UCL	0.515	99% KM Chebyshev UCL	0.721

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.493	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.681	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.305	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.364	k star (bias corrected MLE)	1.879
Theta hat (MLE)	0.0557	Theta star (bias corrected MLE)	0.129
nu hat (MLE)	43.64	nu star (bias corrected)	18.79
Mean (detects)	0.243		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.156
Maximum	0.485	Median	0.145
SD	0.163	CV	1.047
k hat (MLE)	0.728	k star (bias corrected MLE)	0.539
Theta hat (MLE)	0.214	Theta star (bias corrected MLE)	0.289
nu hat (MLE)	11.65	nu star (bias corrected)	8.617
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (8.62, α)	3.097	Adjusted Chi Square Value (8.62, β)	2.323
95% Gamma Approximate UCL (use when n>=50)	0.433	95% Gamma Adjusted UCL (use when n<50)	0.577

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.168	SD (KM)	0.141
Variance (KM)	0.0198	SE of Mean (KM)	0.0556
k hat (KM)	1.434	k star (KM)	0.98
nu hat (KM)	22.95	nu star (KM)	15.68
theta hat (KM)	0.117	theta star (KM)	0.172
80% gamma percentile (KM)	0.271	90% gamma percentile (KM)	0.39
95% gamma percentile (KM)	0.508	99% gamma percentile (KM)	0.783

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.68, α)	7.734	Adjusted Chi Square Value (15.68, β)	6.376
95% Gamma Approximate KM-UCL (use when n>=50)	0.341	95% Gamma Adjusted KM-UCL (use when n<50)	0.414

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.172	Mean in Log Scale	-2.059
SD in Original Scale	0.147	SD in Log Scale	0.825
95% t UCL (assumes normality of ROS data)	0.27	95% Percentile Bootstrap UCL	0.257
95% BCA Bootstrap UCL	0.28	95% Bootstrap t UCL	0.353
95% H-UCL (Log ROS)	0.458		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.13	KM Geo Mean	0.119
KM SD (logged)	0.853	95% Critical H Value (KM-Log)	3.073
KM Standard Error of Mean (logged)	0.337	95% H-UCL (KM -Log)	0.461
KM SD (logged)	0.853	95% Critical H Value (KM-Log)	3.073
KM Standard Error of Mean (logged)	0.337		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.163	Mean in Log Scale	-2.285
SD in Original Scale	0.155	SD in Log Scale	1.125
95% t UCL (Assumes normality)	0.267	95% H-Stat UCL	0.939

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.274

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	1.6	Mean	14.58
Maximum	31	Median	12.5
SD	8.636	Std. Error of Mean	3.053
Coefficient of Variation	0.593	Skewness	0.761

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	20.36	95% Adjusted-CLT UCL (Chen-1995)	20.47
		95% Modified-t UCL (Johnson-1978)	20.5

Gamma GOF Test

A-D Test Statistic	0.637	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.723	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.303	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.297	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.294	k star (bias corrected MLE)	1.517
Theta hat (MLE)	6.352	Theta star (bias corrected MLE)	9.605
nu hat (MLE)	36.71	nu star (bias corrected)	24.28
MLE Mean (bias corrected)	14.58	MLE Sd (bias corrected)	11.83
		Approximate Chi Square Value (0.05)	14.06
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	12.14

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	25.17	95% Adjusted Gamma UCL (use when n<50)	29.15

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.781	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.353	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.47	Mean of logged Data	2.446
Maximum of Logged Data	3.434	SD of logged Data	0.875

Assuming Lognormal Distribution

95% H-UCL	47.5	90% Chebyshev (MVUE) UCL	31.02
95% Chebyshev (MVUE) UCL	37.86	97.5% Chebyshev (MVUE) UCL	47.34
99% Chebyshev (MVUE) UCL	65.97		

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	19.6	95% Jackknife UCL	20.36
95% Standard Bootstrap UCL	19.25	95% Bootstrap-t UCL	23.05
95% Hall's Bootstrap UCL	66.74	95% Percentile Bootstrap UCL	19.38
95% BCA Bootstrap UCL	20.45		
90% Chebyshev(Mean, Sd) UCL	23.74	95% Chebyshev(Mean, Sd) UCL	27.88
97.5% Chebyshev(Mean, Sd) UCL	33.64	99% Chebyshev(Mean, Sd) UCL	44.96

Suggested UCL to Use

95% Student's-t UCL	20.36

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.2

Summary of ProUCL Output for EU12 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 10:36:47 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	5
Number of Detects	1	Number of Non-Detects	7
Number of Distinct Detects	1	Number of Distinct Non-Detects	4

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1254 (PCB-1254) was not processed!

Table B.10.3

Summary of ProUCL Input Data for EU12 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)pyrene	D_Benzo(a)pyrene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Aluminum	D_Aluminum	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)
on-site (EU12)	SS-62	10/30/2018	0.17-2.17 ft BGS	750	1	51	1	130	1	4600	1	6.2	1	0.28	0
on-site (EU12)	SS-63	10/30/2018	0.17-2.17 ft BGS	11	0	23	0	8.3	0	2000	1	2.4	1	0.29	0
on-site (EU12)	SS-64	10/30/2018	0-2 ft BGS	37	1	32	1	17	1	840	1	5.5	1	0.26	0
on-site (EU12)	SS-65	10/30/2018	0.25-2.25 ft BGS	202	1	90	1	56	1	3400	1	27.95	1	0.315	0
on-site (EU12)	SS-66	10/30/2018	0.17-2.17 ft BGS	99	1	21	0	19	1	3400	1	5	1	0.26	0
on-site (EU12)	SS-67	10/30/2018	0.17-2.17 ft BGS	78	1	22	0	13	1	7900	1	9.4	1	0.28	0
on-site (EU12)	SS-68	10/30/2018	0.17-2.17 ft BGS	27	1	21	0	7.7	0	5400	1	8.6	1	0.27	0
on-site (EU12)	SS-69	10/30/2018	0.33-2.33 ft BGS	53	0	110	0	39	0	1400	1	1.7	1	0.27	0
on-site (EU12)	SS-89	10/30/2018	0-2 ft BGS												
on-site (EU12)	SS-167-AS	10/30/2018	0-0.5 ft BGS												
on-site (EU12)	BH83-13	6/24/2013	5-7.5 ft BGS												
on-site (EU12)	BH84-13	6/26/2013	2-4 ft BGS												
on-site (EU12)	BH111-18	1/11/2018	7.5-9.5 ft BGS	770	1	67	0	60	1	10000	1	13	1	1.5	0
on-site (EU12)	BH112-17	12/19/2017	13-15 ft BGS	2	0	83	0	2	0	2000	1	4.4	1	0.3	0
on-site (EU12)	BH113-18	1/3/2018	9-11 ft BGS	16	1	31	0	0.76	0	9000	1	7.5	1	1.4	0
on-site (EU12)	TT-10	10/3/2008	10 ft BGS	10	0	76	0	10	0						
on-site (EU12)	TT-10	10/3/2008	10- ft BGS							3550	1	47.8	1	2.1	1
on-site (EU12)	TT-10	10/3/2008	15 ft BGS	10	0	78	0	10	0						
on-site (EU12)	TT-10	10/3/2008	15- ft BGS							3910	1	51.2	1	2.4	1
on-site (EU12)	TT-10	10/3/2008	5 ft BGS			61	0	8.1	0						
on-site (EU12)	TT-10	10/3/2008	5- ft BGS	23	1					2120	1	21.6	1	1.1	1

Table B.10.3

Summary of ProUCL Input Data for EU12 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Cobalt	D_Cobalt	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU12)	SS-62	10/30/2018	0.17-2.17 ft BGS	4.9	1	9300	1	230	1	0.17	1	14	1	210	1
on-site (EU12)	SS-63	10/30/2018	0.17-2.17 ft BGS	2.8	1	4800	1	110	1	0.052	0	12	1	27	0
on-site (EU12)	SS-64	10/30/2018	0-2 ft BGS	6.4	1	5500	1	15	1	0.086	0	12	1	25	0
on-site (EU12)	SS-65	10/30/2018	0.25-2.25 ft BGS	5.25	1	5500	1	128.5	1	0.485	1	31	1	30	0
on-site (EU12)	SS-66	10/30/2018	0.17-2.17 ft BGS	3.7	1	9900	1	400	1	0.14	1	11	1	25	0
on-site (EU12)	SS-67	10/30/2018	0.17-2.17 ft BGS	7.1	1	12000	1	390	1	0.27	1	22	1	27	0
on-site (EU12)	SS-68	10/30/2018	0.17-2.17 ft BGS	4	1	10000	1	410	1	0.15	1	13	1	25	0
on-site (EU12)	SS-69	10/30/2018	0.33-2.33 ft BGS	0.76	1	10000	1	100	1	0.044	0	1.6	1	26	0
on-site (EU12)	SS-89	10/30/2018	0-2 ft BGS												
on-site (EU12)	SS-167-AS	10/30/2018	0-0.5 ft BGS												
on-site (EU12)	BH83-13	6/24/2013	5-7.5 ft BGS												
on-site (EU12)	BH84-13	6/26/2013	2-4 ft BGS												
on-site (EU12)	BH111-18	1/11/2018	7.5-9.5 ft BGS	7.1	1	23000	1	750	1	0.25	1	27	1	150	1
on-site (EU12)	BH112-17	12/19/2017	13-15 ft BGS	3.2	1	38000	1	2600	1	0.057	0	5	1	28	0
on-site (EU12)	BH113-18	1/3/2018	9-11 ft BGS	6.8	1	17000	1	500	1	0.16	1	26	1	26	0
on-site (EU12)	TT-10	10/3/2008	10 ft BGS							0.76	0			50	0
on-site (EU12)	TT-10	10/3/2008	10- ft BGS	4.9	1	4670	1	13.5	1			44.6	1		
on-site (EU12)	TT-10	10/3/2008	15 ft BGS											51	0
on-site (EU12)	TT-10	10/3/2008	15- ft BGS	5.9	1	5880	1	19.7	1	1.1	1	47.2	1		
on-site (EU12)	TT-10	10/3/2008	5 ft BGS											40	0
on-site (EU12)	TT-10	10/3/2008	5- ft BGS	2.7	1	4410	1	18.6	1	0.45	1	23.4	1		

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	7
Number of Detects	9	Number of Non-Detects	5
Number of Distinct Detects	9	Number of Distinct Non-Detects	4
Minimum Detect	16	Minimum Non-Detect	2
Maximum Detect	770	Maximum Non-Detect	53
Variance Detects	96205	Percent Non-Detects	35.71%
Mean Detects	222.4	SD Detects	310.2
Median Detects	78	CV Detects	1.394
Skewness Detects	1.484	Kurtosis Detects	0.466
Mean of Logged Detects	4.482	SD of Logged Detects	1.452

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.674	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.321	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	144.6	KM Standard Error of Mean	72.78
KM SD	256.7	95% KM (BCA) UCL	276.7
95% KM (t) UCL	273.5	95% KM (Percentile Bootstrap) UCL	263.8
95% KM (z) UCL	264.3	95% KM Bootstrap t UCL	656.1
90% KM Chebyshev UCL	362.9	95% KM Chebyshev UCL	461.8
97.5% KM Chebyshev UCL	599.1	99% KM Chebyshev UCL	868.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.668	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.758	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.226	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.291	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.661	k star (bias corrected MLE)	0.514
Theta hat (MLE)	336.7	Theta star (bias corrected MLE)	432.4
nu hat (MLE)	11.89	nu star (bias corrected)	9.261
Mean (detects)	222.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	143
Maximum	770	Median	25
SD	267.3	CV	1.869
k hat (MLE)	0.198	k star (bias corrected MLE)	0.203
Theta hat (MLE)	722.8	Theta star (bias corrected MLE)	704.2
nu hat (MLE)	5.54	nu star (bias corrected)	5.686
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (5.69, α)	1.481	Adjusted Chi Square Value (5.69, β)	1.217
95% Gamma Approximate UCL (use when n>=50)	548.8	95% Gamma Adjusted UCL (use when n<50)	668

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	144.6	SD (KM)	256.7
Variance (KM)	65912	SE of Mean (KM)	72.78
k hat (KM)	0.317	k star (KM)	0.297
nu hat (KM)	8.878	nu star (KM)	8.309
theta hat (KM)	455.9	theta star (KM)	487.2
80% gamma percentile (KM)	221.1	90% gamma percentile (KM)	426.9
95% gamma percentile (KM)	663.6	99% gamma percentile (KM)	1280

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.31, α)	2.915	Adjusted Chi Square Value (8.31, β)	2.508
95% Gamma Approximate KM-UCL (use when n>=50)	412	95% Gamma Adjusted KM-UCL (use when n<50)	479

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	144.5	Mean in Log Scale	3.326
SD in Original Scale	266.4	SD in Log Scale	2.006
95% t UCL (assumes normality of ROS data)	270.6	95% Percentile Bootstrap UCL	259.3
95% BCA Bootstrap UCL	297.3	95% Bootstrap t UCL	674.9
95% H-UCL (Log ROS)	2823		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.219	KM Geo Mean	25
KM SD (logged)	2.07	95% Critical H Value (KM-Log)	4.816
KM Standard Error of Mean (logged)	0.596	95% H-UCL (KM -Log)	3382
KM SD (logged)	2.07	95% Critical H Value (KM-Log)	4.816
KM Standard Error of Mean (logged)	0.596		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	146.1	Mean in Log Scale	3.467
SD in Original Scale	265.6	SD in Log Scale	1.926
95% t UCL (Assumes normality)	271.8	95% H-Stat UCL	2295

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	656.1	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	479

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	6
Number of Detects	3	Number of Non-Detects	11
Number of Distinct Detects	3	Number of Distinct Non-Detects	10
Minimum Detect	32	Minimum Non-Detect	21
Maximum Detect	90	Maximum Non-Detect	110
Variance Detects	874.3	Percent Non-Detects	78.57%
Mean Detects	57.67	SD Detects	29.57
Median Detects	51	CV Detects	0.513
Skewness Detects	0.963	Kurtosis Detects	N/A
Mean of Logged Detects	3.966	SD of Logged Detects	0.518

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	31.71	KM Standard Error of Mean	7.282
KM SD	19.65	95% KM (BCA) UCL	N/A
95% KM (t) UCL	44.61	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	43.69	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	53.56	95% KM Chebyshev UCL	63.46
97.5% KM Chebyshev UCL	77.19	99% KM Chebyshev UCL	104.2

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	5.787	k star (bias corrected MLE)	N/A
Theta hat (MLE)	9.966	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	34.72	nu star (bias corrected)	N/A
Mean (detects)	57.67		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	13.95
Maximum	90	Median	2.95
SD	26.44	CV	1.896
k hat (MLE)	0.271	k star (bias corrected MLE)	0.261
Theta hat (MLE)	51.44	Theta star (bias corrected MLE)	53.5
nu hat (MLE)	7.592	nu star (bias corrected)	7.299
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (7.30, α)	2.336	Adjusted Chi Square Value (7.30, β)	1.981
95% Gamma Approximate UCL (use when n>=50)	43.58	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	31.71	SD (KM)	19.65
Variance (KM)	386.1	SE of Mean (KM)	7.282
k hat (KM)	2.605	k star (KM)	2.095
nu hat (KM)	72.95	nu star (KM)	58.65
theta hat (KM)	12.17	theta star (KM)	15.14
80% gamma percentile (KM)	47.22	90% gamma percentile (KM)	61.02
95% gamma percentile (KM)	74.14	99% gamma percentile (KM)	103.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (58.65, α)	42.04	Adjusted Chi Square Value (58.65, β)	40.18
95% Gamma Approximate KM-UCL (use when n>=50)	44.24	95% Gamma Adjusted KM-UCL (use when n<50)	46.29

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.997	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	24.62	Mean in Log Scale	2.994
SD in Original Scale	21.5	SD in Log Scale	0.595
95% t UCL (assumes normality of ROS data)	34.8	95% Percentile Bootstrap UCL	33.77
95% BCA Bootstrap UCL	39.4	95% Bootstrap t UCL	57.5
95% H-UCL (Log ROS)	34.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.329	KM Geo Mean	27.91
KM SD (logged)	0.457	95% Critical H Value (KM-Log)	2.006
KM Standard Error of Mean (logged)	0.179	95% H-UCL (KM -Log)	39.97
KM SD (logged)	0.457	95% Critical H Value (KM-Log)	2.006
KM Standard Error of Mean (logged)	0.179		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	33.54	Mean in Log Scale	3.296
SD in Original Scale	22.29	SD in Log Scale	0.708
95% t UCL (Assumes normality)	44.09	95% H-Stat UCL	55

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	44.61

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	6
Number of Detects	6	Number of Non-Detects	8
Number of Distinct Detects	6	Number of Distinct Non-Detects	7
Minimum Detect	13	Minimum Non-Detect	0.76
Maximum Detect	130	Maximum Non-Detect	39
Variance Detects	1990	Percent Non-Detects	57.14%
Mean Detects	49.17	SD Detects	44.61
Median Detects	37.5	CV Detects	0.907
Skewness Detects	1.425	Kurtosis Detects	1.936
Mean of Logged Detects	3.555	SD of Logged Detects	0.907

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.824	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	21.84	KM Standard Error of Mean	10.48
KM SD	35.72	95% KM (BCA) UCL	42.29
95% KM (t) UCL	40.39	95% KM (Percentile Bootstrap) UCL	40.11
95% KM (z) UCL	39.07	95% KM Bootstrap t UCL	49.06
90% KM Chebyshev UCL	53.26	95% KM Chebyshev UCL	67.5
97.5% KM Chebyshev UCL	87.26	99% KM Chebyshev UCL	126.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.421	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.278	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.337	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.616	k star (bias corrected MLE)	0.919
Theta hat (MLE)	30.42	Theta star (bias corrected MLE)	53.49
nu hat (MLE)	19.39	nu star (bias corrected)	11.03
Mean (detects)	49.17		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	21.08
Maximum	130	Median	0.01
SD	37.45	CV	1.777
k hat (MLE)	0.18	k star (bias corrected MLE)	0.189
Theta hat (MLE)	117.1	Theta star (bias corrected MLE)	111.5
nu hat (MLE)	5.039	nu star (bias corrected)	5.293
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (5.29, α)	1.29	Adjusted Chi Square Value (5.29, β)	1.049
95% Gamma Approximate UCL (use when n>=50)	86.49	95% Gamma Adjusted UCL (use when n<50)	106.3

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	21.84	SD (KM)	35.72
Variance (KM)	1276	SE of Mean (KM)	10.48
k hat (KM)	0.374	k star (KM)	0.341
nu hat (KM)	10.47	nu star (KM)	9.557
theta hat (KM)	58.43	theta star (KM)	63.99
80% gamma percentile (KM)	34.43	90% gamma percentile (KM)	63.31
95% gamma percentile (KM)	95.77	99% gamma percentile (KM)	178.9

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.56, α)	3.667	Adjusted Chi Square Value (9.56, β)	3.198
95% Gamma Approximate KM-UCL (use when n>=50)	56.92	95% Gamma Adjusted KM-UCL (use when n<50)	65.27

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.25	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	22.82	Mean in Log Scale	2.136
SD in Original Scale	36.42	SD in Log Scale	1.415
95% t UCL (assumes normality of ROS data)	40.06	95% Percentile Bootstrap UCL	38.99
95% BCA Bootstrap UCL	46.08	95% Bootstrap t UCL	57.55
95% H-UCL (Log ROS)	92.05		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.432	KM Geo Mean	4.188
KM SD (logged)	1.966	95% Critical H Value (KM-Log)	4.607
KM Standard Error of Mean (logged)	0.587	95% H-UCL (KM -Log)	356.9
KM SD (logged)	1.966	95% Critical H Value (KM-Log)	4.607
KM Standard Error of Mean (logged)	0.587		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	24.14	Mean in Log Scale	2.194
SD in Original Scale	35.93	SD in Log Scale	1.6
95% t UCL (Assumes normality)	41.14	95% H-Stat UCL	180.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	40.39

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	7
Minimum	840	Mean	4251
Maximum	10000	Median	3475
SD	2867	Std. Error of Mean	766.2
Coefficient of Variation	0.674	Skewness	0.953

Normal GOF Test

Shapiro Wilk Test Statistic	0.889	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.19	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5608	95% Adjusted-CLT UCL (Chen-1995)	5720
		95% Modified-t UCL (Johnson-1978)	5641

Gamma GOF Test

A-D Test Statistic	0.265	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.128	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.231	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.408	k star (bias corrected MLE)	1.94
Theta hat (MLE)	1765	Theta star (bias corrected MLE)	2192
nu hat (MLE)	67.43	nu star (bias corrected)	54.32
MLE Mean (bias corrected)	4251	MLE Sd (bias corrected)	3052
		Approximate Chi Square Value (0.05)	38.38
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	36.61

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6016	95% Adjusted Gamma UCL (use when n<50)	6308

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.733	Mean of logged Data	8.133
Maximum of Logged Data	9.21	SD of logged Data	0.717

Assuming Lognormal Distribution

95% H-UCL	7037	90% Chebyshev (MVUE) UCL	6912
95% Chebyshev (MVUE) UCL	8092	97.5% Chebyshev (MVUE) UCL	9729
99% Chebyshev (MVUE) UCL	12946		

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5512	95% Jackknife UCL	5608
95% Standard Bootstrap UCL	5457	95% Bootstrap-t UCL	6111
95% Hall's Bootstrap UCL	5722	95% Percentile Bootstrap UCL	5494
95% BCA Bootstrap UCL	5709		
90% Chebyshev(Mean, Sd) UCL	6550	95% Chebyshev(Mean, Sd) UCL	7591
97.5% Chebyshev(Mean, Sd) UCL	9037	99% Chebyshev(Mean, Sd) UCL	11875

Suggested UCL to Use

95% Student's-t UCL	5608

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	7
Minimum	1.7	Mean	15.16
Maximum	51.2	Median	8.05
SD	16.28	Std. Error of Mean	4.351
Coefficient of Variation	1.074	Skewness	1.551

Normal GOF Test

Shapiro Wilk Test Statistic	0.756	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	22.87	95% Adjusted-CLT UCL (Chen-1995)	24.24
		95% Modified-t UCL (Johnson-1978)	23.17

Gamma GOF Test

A-D Test Statistic	0.539	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.204	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.234	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.159	k star (bias corrected MLE)	0.958
Theta hat (MLE)	13.08	Theta star (bias corrected MLE)	15.82
nu hat (MLE)	32.45	nu star (bias corrected)	26.83
MLE Mean (bias corrected)	15.16	MLE Sd (bias corrected)	15.49
		Approximate Chi Square Value (0.05)	16.02
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	14.92

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	25.39	95% Adjusted Gamma UCL (use when n<50)	27.26

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.138	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.531	Mean of logged Data	2.229
Maximum of Logged Data	3.936	SD of logged Data	1.03

Assuming Lognormal Distribution

95% H-UCL	35.53	90% Chebyshev (MVUE) UCL	28.43
95% Chebyshev (MVUE) UCL	34.53	97.5% Chebyshev (MVUE) UCL	42.99
99% Chebyshev (MVUE) UCL	59.61		

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	22.32	95% Jackknife UCL	22.87
95% Standard Bootstrap UCL	22.26	95% Bootstrap-t UCL	29.45
95% Hall's Bootstrap UCL	27.13	95% Percentile Bootstrap UCL	22.65
95% BCA Bootstrap UCL	24.06		
90% Chebyshev(Mean, Sd) UCL	28.21	95% Chebyshev(Mean, Sd) UCL	34.13
97.5% Chebyshev(Mean, Sd) UCL	42.33	99% Chebyshev(Mean, Sd) UCL	58.45

Suggested UCL to Use

95% Adjusted Gamma UCL	27.26

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	11
		Number of Missing Observations	7
Number of Detects	3	Number of Non-Detects	11
Number of Distinct Detects	3	Number of Distinct Non-Detects	8
Minimum Detect	1.1	Minimum Non-Detect	0.26
Maximum Detect	2.4	Maximum Non-Detect	1.5
Variance Detects	0.463	Percent Non-Detects	78.57%
Mean Detects	1.867	SD Detects	0.681
Median Detects	2.1	CV Detects	0.365
Skewness Detects	-1.361	Kurtosis Detects	N/A
Mean of Logged Detects	0.571	SD of Logged Detects	0.417

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.616	KM Standard Error of Mean	0.235
KM SD	0.709	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.032	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.002	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.32	95% KM Chebyshev UCL	1.639
97.5% KM Chebyshev UCL	2.081	99% KM Chebyshev UCL	2.95

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	9.554	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.195	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	57.32	nu star (bias corrected)	N/A
Mean (detects)	1.867		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.408
Maximum	2.4	Median	0.01
SD	0.834	CV	2.046
k hat (MLE)	0.27	k star (bias corrected MLE)	0.26
Theta hat (MLE)	1.511	Theta star (bias corrected MLE)	1.571
nu hat (MLE)	7.557	nu star (bias corrected)	7.271
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (7.27, α)	2.321	Adjusted Chi Square Value (7.27, β)	1.967
95% Gamma Approximate UCL (use when n>=50)	1.278	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.616	SD (KM)	0.709
Variance (KM)	0.502	SE of Mean (KM)	0.235
k hat (KM)	0.756	k star (KM)	0.642
nu hat (KM)	21.16	nu star (KM)	17.96
theta hat (KM)	0.815	theta star (KM)	0.961
80% gamma percentile (KM)	1.015	90% gamma percentile (KM)	1.579
95% gamma percentile (KM)	2.165	99% gamma percentile (KM)	3.574

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.96, α)	9.364	Adjusted Chi Square Value (17.96, β)	8.55
95% Gamma Approximate KM-UCL (use when n>=50)	1.182	95% Gamma Adjusted KM-UCL (use when n<50)	1.295

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.874	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.326	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.689	Mean in Log Scale	-0.689
SD in Original Scale	0.697	SD in Log Scale	0.743
95% t UCL (assumes normality of ROS data)	1.019	95% Percentile Bootstrap UCL	1.022
95% BCA Bootstrap UCL	1.119	95% Bootstrap t UCL	1.564
95% H-UCL (Log ROS)	1.084		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.915	KM Geo Mean	0.4
KM SD (logged)	0.81	95% Critical H Value (KM-Log)	2.494
KM Standard Error of Mean (logged)	0.272	95% H-UCL (KM -Log)	0.974
KM SD (logged)	0.81	95% Critical H Value (KM-Log)	2.494
KM Standard Error of Mean (logged)	0.272		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.594	Mean in Log Scale	-1.188
SD in Original Scale	0.768	SD in Log Scale	1.13
95% t UCL (Assumes normality)	0.957	95% H-Stat UCL	1.486

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.032

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	7
Minimum	0.76	Mean	4.679
Maximum	7.1	Median	4.9
SD	1.912	Std. Error of Mean	0.511
Coefficient of Variation	0.409	Skewness	-0.437

Normal GOF Test

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.117	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.584	95% Adjusted-CLT UCL (Chen-1995)	5.456
		95% Modified-t UCL (Johnson-1978)	5.574

Gamma GOF Test

A-D Test Statistic	0.528	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.173	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.23	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.295	k star (bias corrected MLE)	3.422
Theta hat (MLE)	1.09	Theta star (bias corrected MLE)	1.367
nu hat (MLE)	120.3	nu star (bias corrected)	95.82
MLE Mean (bias corrected)	4.679	MLE Sd (bias corrected)	2.529
		Approximate Chi Square Value (0.05)	74.24
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	71.73

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6.039	95% Adjusted Gamma UCL (use when n<50)	6.251

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.807	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.183	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.274	Mean of logged Data	1.422
Maximum of Logged Data	1.96	SD of logged Data	0.591

Assuming Lognormal Distribution

95% H-UCL	7.063	90% Chebyshev (MVUE) UCL	7.265
95% Chebyshev (MVUE) UCL	8.35	97.5% Chebyshev (MVUE) UCL	9.856
99% Chebyshev (MVUE) UCL	12.82		

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.52	95% Jackknife UCL	5.584
95% Standard Bootstrap UCL	5.48	95% Bootstrap-t UCL	5.544
95% Hall's Bootstrap UCL	5.455	95% Percentile Bootstrap UCL	5.454
95% BCA Bootstrap UCL	5.429		
90% Chebyshev(Mean, Sd) UCL	6.212	95% Chebyshev(Mean, Sd) UCL	6.906
97.5% Chebyshev(Mean, Sd) UCL	7.87	99% Chebyshev(Mean, Sd) UCL	9.763

Suggested UCL to Use

95% Student's-t UCL	5.584

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	14	Number of Distinct Observations	12
		Number of Missing Observations	7
Minimum	4410	Mean	11426
Maximum	38000	Median	9600
SD	9291	Std. Error of Mean	2483
Coefficient of Variation	0.813	Skewness	2.119

Normal GOF Test

Shapiro Wilk Test Statistic	0.737	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.275	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15823	95% Adjusted-CLT UCL (Chen-1995)	17013
		95% Modified-t UCL (Johnson-1978)	16058

Gamma GOF Test

A-D Test Statistic	0.731	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.208	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.231	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.405	k star (bias corrected MLE)	1.938
Theta hat (MLE)	4750	Theta star (bias corrected MLE)	5897
nu hat (MLE)	67.35	nu star (bias corrected)	54.25
MLE Mean (bias corrected)	11426	MLE Sd (bias corrected)	8208
		Approximate Chi Square Value (0.05)	38.33
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	36.56

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	16173	95% Adjusted Gamma UCL (use when n<50)	16956

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.392	Mean of logged Data	9.122
Maximum of Logged Data	10.55	SD of logged Data	0.649

Assuming Lognormal Distribution

95% H-UCL	17016	90% Chebyshev (MVUE) UCL	17127
95% Chebyshev (MVUE) UCL	19858	97.5% Chebyshev (MVUE) UCL	23648
99% Chebyshev (MVUE) UCL	31094		

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	15510	95% Jackknife UCL	15823
95% Standard Bootstrap UCL	15459	95% Bootstrap-t UCL	20589
95% Hall's Bootstrap UCL	33851	95% Percentile Bootstrap UCL	15484
95% BCA Bootstrap UCL	16859		
90% Chebyshev(Mean, Sd) UCL	18875	95% Chebyshev(Mean, Sd) UCL	22249
97.5% Chebyshev(Mean, Sd) UCL	26933	99% Chebyshev(Mean, Sd) UCL	36133

Suggested UCL to Use

95% Adjusted Gamma UCL	16956

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	7
Minimum	13.5	Mean	406.1
Maximum	2600	Median	179.3
SD	670.1	Std. Error of Mean	179.1
Coefficient of Variation	1.65	Skewness	3.068

Normal GOF Test

Shapiro Wilk Test Statistic	0.587	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	723.2	95% Adjusted-CLT UCL (Chen-1995)	857.5
		95% Modified-t UCL (Johnson-1978)	747.7

Gamma GOF Test

A-D Test Statistic	0.454	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.785	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.151	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.24	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.593	k star (bias corrected MLE)	0.514
Theta hat (MLE)	684.6	Theta star (bias corrected MLE)	790.5
nu hat (MLE)	16.61	nu star (bias corrected)	14.38
MLE Mean (bias corrected)	406.1	MLE Sd (bias corrected)	566.6
		Approximate Chi Square Value (0.05)	6.835
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	6.157

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	854.6	95% Adjusted Gamma UCL (use when n<50)	948.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.603	Mean of logged Data	4.963
Maximum of Logged Data	7.863	SD of logged Data	1.643

Assuming Lognormal Distribution

95% H-UCL	3358	90% Chebyshev (MVUE) UCL	1142
95% Chebyshev (MVUE) UCL	1452	97.5% Chebyshev (MVUE) UCL	1882
99% Chebyshev (MVUE) UCL	2726		

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	700.7	95% Jackknife UCL	723.2
95% Standard Bootstrap UCL	697.4	95% Bootstrap-t UCL	1262
95% Hall's Bootstrap UCL	1871	95% Percentile Bootstrap UCL	724.8
95% BCA Bootstrap UCL	867.3		
90% Chebyshev(Mean, Sd) UCL	943.3	95% Chebyshev(Mean, Sd) UCL	1187
97.5% Chebyshev(Mean, Sd) UCL	1524	99% Chebyshev(Mean, Sd) UCL	2188

Suggested UCL to Use

95% Adjusted Gamma UCL	948.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	7
Number of Detects	9	Number of Non-Detects	5
Number of Distinct Detects	9	Number of Distinct Non-Detects	5
Minimum Detect	0.14	Minimum Non-Detect	0.044
Maximum Detect	1.1	Maximum Non-Detect	0.76
Variance Detects	0.095	Percent Non-Detects	35.71%
Mean Detects	0.353	SD Detects	0.308
Median Detects	0.25	CV Detects	0.873
Skewness Detects	2.129	Kurtosis Detects	4.891
Mean of Logged Detects	-1.288	SD of Logged Detects	0.693

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.722	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.273	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.253	KM Standard Error of Mean	0.0785
KM SD	0.274	95% KM (BCA) UCL	0.4
95% KM (t) UCL	0.392	95% KM (Percentile Bootstrap) UCL	0.394
95% KM (z) UCL	0.382	95% KM Bootstrap t UCL	0.506
90% KM Chebyshev UCL	0.488	95% KM Chebyshev UCL	0.595
97.5% KM Chebyshev UCL	0.743	99% KM Chebyshev UCL	1.033

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.626	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.225	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.186	k star (bias corrected MLE)	1.531
Theta hat (MLE)	0.161	Theta star (bias corrected MLE)	0.23
nu hat (MLE)	39.34	nu star (bias corrected)	27.56
Mean (detects)	0.353		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.237
Maximum	1.1	Median	0.155
SD	0.291	CV	1.227
k hat (MLE)	0.699	k star (bias corrected MLE)	0.597
Theta hat (MLE)	0.339	Theta star (bias corrected MLE)	0.398
nu hat (MLE)	19.58	nu star (bias corrected)	16.72
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (16.72, α)	8.471	Adjusted Chi Square Value (16.72, β)	7.703
95% Gamma Approximate UCL (use when n>=50)	0.468	95% Gamma Adjusted UCL (use when n<50)	0.515

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.253	SD (KM)	0.274
Variance (KM)	0.075	SE of Mean (KM)	0.0785
k hat (KM)	0.852	k star (KM)	0.717
nu hat (KM)	23.86	nu star (KM)	20.08
theta hat (KM)	0.297	theta star (KM)	0.352
80% gamma percentile (KM)	0.415	90% gamma percentile (KM)	0.631
95% gamma percentile (KM)	0.853	99% gamma percentile (KM)	1.382

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.08, α)	10.91	Adjusted Chi Square Value (20.08, β)	10.02
95% Gamma Approximate KM-UCL (use when n>=50)	0.465	95% Gamma Adjusted KM-UCL (use when n<50)	0.506

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.254	Mean in Log Scale	-1.778
SD in Original Scale	0.279	SD in Log Scale	0.905
95% t UCL (assumes normality of ROS data)	0.386	95% Percentile Bootstrap UCL	0.389
95% BCA Bootstrap UCL	0.432	95% Bootstrap t UCL	0.53
95% H-UCL (Log ROS)	0.493		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.864	KM Geo Mean	0.155
KM SD (logged)	0.998	95% Critical H Value (KM-Log)	2.789
KM Standard Error of Mean (logged)	0.291	95% H-UCL (KM -Log)	0.552
KM SD (logged)	0.998	95% Critical H Value (KM-Log)	2.789
KM Standard Error of Mean (logged)	0.291		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.262	Mean in Log Scale	-1.909
SD in Original Scale	0.286	SD in Log Scale	1.213
95% t UCL (Assumes normality)	0.398	95% H-Stat UCL	0.895

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.392

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	7
Minimum	1.6	Mean	20.7
Maximum	47.2	Median	18
SD	13.64	Std. Error of Mean	3.644
Coefficient of Variation	0.659	Skewness	0.706

Normal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	27.15	95% Adjusted-CLT UCL (Chen-1995)	27.43
		95% Modified-t UCL (Johnson-1978)	27.27

Gamma GOF Test

A-D Test Statistic	0.3	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.149	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.232	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.951	k star (bias corrected MLE)	1.581
Theta hat (MLE)	10.61	Theta star (bias corrected MLE)	13.1
nu hat (MLE)	54.63	nu star (bias corrected)	44.26
MLE Mean (bias corrected)	20.7	MLE Sd (bias corrected)	16.46
		Approximate Chi Square Value (0.05)	30
Adjusted Level of Significance	0.0312	Adjusted Chi Square Value	28.45

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	30.54	95% Adjusted Gamma UCL (use when n<50)	32.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.874	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.226	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.47	Mean of logged Data	2.752
Maximum of Logged Data	3.854	SD of logged Data	0.896

Assuming Lognormal Distribution

95% H-UCL	44.95	90% Chebyshev (MVUE) UCL	39.96
95% Chebyshev (MVUE) UCL	47.84	97.5% Chebyshev (MVUE) UCL	58.78
99% Chebyshev (MVUE) UCL	80.26		

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	26.69	95% Jackknife UCL	27.15
95% Standard Bootstrap UCL	26.53	95% Bootstrap-t UCL	27.82
95% Hall's Bootstrap UCL	27.68	95% Percentile Bootstrap UCL	26.61
95% BCA Bootstrap UCL	27.16		
90% Chebyshev(Mean, Sd) UCL	31.63	95% Chebyshev(Mean, Sd) UCL	36.59
97.5% Chebyshev(Mean, Sd) UCL	43.46	99% Chebyshev(Mean, Sd) UCL	56.96

Suggested UCL to Use

95% Student's-t UCL	27.15

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	10
		Number of Missing Observations	6
Number of Detects	2	Number of Non-Detects	12
Number of Distinct Detects	2	Number of Distinct Non-Detects	8
Minimum Detect	150	Minimum Non-Detect	25
Maximum Detect	210	Maximum Non-Detect	51
Variance Detects	1800	Percent Non-Detects	85.71%
Mean Detects	180	SD Detects	42.43
Median Detects	180	CV Detects	0.236
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	5.179	SD of Logged Detects	0.238

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	47.14	KM Standard Error of Mean	20.94
KM SD	55.41	95% KM (BCA) UCL	N/A
95% KM (t) UCL	84.23	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	81.59	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	110	95% KM Chebyshev UCL	138.4
97.5% KM Chebyshev UCL	177.9	99% KM Chebyshev UCL	255.5

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	35.66	k star (bias corrected MLE)	N/A
Theta hat (MLE)	5.047	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	142.7	nu star (bias corrected)	N/A
Mean (detects)	180		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	47.14	SD (KM)	55.41
Variance (KM)	3070	SE of Mean (KM)	20.94
k hat (KM)	0.724	k star (KM)	0.616
nu hat (KM)	20.27	nu star (KM)	17.26
theta hat (KM)	65.13	theta star (KM)	76.49
80% gamma percentile (KM)	77.7	90% gamma percentile (KM)	121.9
95% gamma percentile (KM)	168	99% gamma percentile (KM)	279.3

Table B.10.4

Summary of ProUCL Output for EU012 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 5:45:07 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0312
Approximate Chi Square Value (17.26, α)	8.857	Adjusted Chi Square Value (17.26, β)	8.069
95% Gamma Approximate KM-UCL (use when n>=50)	91.86	95% Gamma Adjusted KM-UCL (use when n<50)	100.8

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	58.72	Mean in Log Scale	3.831
SD in Original Scale	53.84	SD in Log Scale	0.643
95% t UCL (assumes normality of ROS data)	84.2	95% Percentile Bootstrap UCL	82.69
95% BCA Bootstrap UCL	90.5	95% Bootstrap t UCL	157.2
95% H-UCL (Log ROS)	84.99		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.499	KM Geo Mean	33.08
KM SD (logged)	0.689	95% Critical H Value (KM-Log)	2.325
KM Standard Error of Mean (logged)	0.26	95% H-UCL (KM -Log)	65.38
KM SD (logged)	0.689	95% Critical H Value (KM-Log)	2.325
KM Standard Error of Mean (logged)	0.26		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	39.29	Mean in Log Scale	3.076
SD in Original Scale	60.93	SD in Log Scale	0.926
95% t UCL (Assumes normality)	68.12	95% H-Stat UCL	66.19

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	84.23	KM H-UCL	65.38
95% KM (BCA) UCL	N/A		

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.1

Summary of ProUCL Input Data for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Trichloroethene	D_Trichloroethene	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS	6.5	0	3.3	1								
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	10.5	0	1195	1	175	1	220	1	450	1	21	1
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	25	1	107.5	1	75	1	63	1	87	1	31.5	0
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	13	0	4000	1	5200	1	5200	1	8000	1	1100	1
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	21	0	13000	1	5.1	0	15	1	10	1	29	0
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	1.2	0	1.5	0	61	1	46	1	67	1	38	0
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS					650	1	850	0	660	1	1700	0
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	25	0	270	1	30	1	28	1	47	1	25	0
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	0.81	0	5.3	1	1500	1	1100	1	2900	1	170	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS												
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS												

Table B.11.1

Summary of ProUCL Input Data for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23	24	25
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Naphthalene	D_Naphthalene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS														
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	73	1	205	1	70.5	1	7000	1	707	1	70.5	1	95	1
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	15	1	42	1	96	1	5300	1	1.15	1	18.5	1	240	1
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	920	1	3100	1	390	1	8400	1	18	1	23	1	1800	1
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	10	0	11	0	3.6	0	7100	1	0.68	1	19	1	770	1
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	0.93	0	17	1	230	1	1700	1	0.33	0	7.9	1	57	1
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	630	0	670	0	4200	1	4500	1	0.59	1	3.6	1	55	1
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	9.2	0	9.8	0	140	1	7700	1	2.1	1	70	1	460	1
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	310	1	820	1	290	1	7800	1	23	1	52	1	1100	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS														
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS														

Table B.11.1

Summary of ProUCL Input Data for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				26	27	28	29	30	31	32	33	34	35	36	37	38	39
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS														
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	1.8	1	0.84	1	5.85	1	945	1	0.225	0	25000	1	13355	1
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	0.21	1	0.4	0	13	1	60.5	1	0.41	1	12250	1	41.5	1
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	13	1	0.29	0	17	1	1600	1	0.77	1	76000	1	1900	1
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	0.16	0	1.4	1	8.1	1	44	1	1.7	1	4800	1	38	1
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	0.44	1	0.5	1	2.9	1	12	1	1.9	1	7200	1	2.9	1
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	0.36	1	1.3	0	2.2	1	54	1	0.22	0	6400	1	190	1
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	1.4	1	1.6	0	13	1	310	1	4.1	1	13000	1	220	1
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	30	1	0.26	0	24	1	3300	1	0.38	1	180000	1	3400	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS														
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS														

Table B.11.1

Summary of ProUCL Input Data for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				40	41	42	43	44	45	46	47
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Lead - coarse fraction	D_Lead - coarse fraction	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)	Manganese	D_Manganese
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS								
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS							470	1
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS							79.5	1
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS							580	1
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS							20	1
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS							150	1
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	6300	1	5300	1	35	1	560	1
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS							60	1
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	980	1	1500	1	1100	1	2300	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS								
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS								

Table B.11.1

Summary of ProUCL Input Data for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				48	49	50	51	52	53	54	55	56	57	58	59	60	61
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Mercury	D_Mercury	Nickel	D_Nickel	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Heptachlor epoxide	D_Heptachlor epoxide
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS														
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	0.0095	1	117	1	0.15	1	19.5	1	1150	1	25.5	0	8.8	0
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	0.12	1	24	1	0.845	1	34.5	1	40	1	62	1	17.5	0
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	0.57	1	100	1	0.25	1	31	1	3100	1	63	1	17	0
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	0.18	1	17	1	0.28	1	36	1	87	1	700	1	21	0
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	0.039	1	10	1	0.21	1	7.8	1	47	1	20	0	35	0
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	0.19	1	6	1	0.067	0	9.1	1	36	1	140000	1	150	0
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	0.087	1	29	1	2	1	66	1	120	1	11000	1	75	1
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	3.2	1	310	1	1	1	130	1	3400	1	100	1	15	0
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS														
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS														

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	1
Number of Detects	1	Number of Non-Detects	7
Number of Distinct Detects	1	Number of Distinct Non-Detects	7

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,1-Dichloroethane was not processed!

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	3.3	Minimum Non-Detect	1.5
Maximum Detect	13000	Maximum Non-Detect	1.5
Variance Detects	22865009	Percent Non-Detects	12.5%
Mean Detects	2654	SD Detects	4782
Median Detects	270	CV Detects	1.801
Skewness Detects	2.218	Kurtosis Detects	4.987
Mean of Logged Detects	5.427	SD of Logged Detects	3.162

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.653	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.334	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2323	KM Standard Error of Mean	1617
KM SD	4233	95% KM (BCA) UCL	5072
95% KM (t) UCL	5385	95% KM (Percentile Bootstrap) UCL	4977
95% KM (z) UCL	4982	95% KM Bootstrap t UCL	25240
90% KM Chebyshev UCL	7172	95% KM Chebyshev UCL	9369
97.5% KM Chebyshev UCL	12418	99% KM Chebyshev UCL	18407

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.24	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.791	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.167	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.336	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.283	k star (bias corrected MLE)	0.257
Theta hat (MLE)	9370	Theta star (bias corrected MLE)	10323
nu hat (MLE)	3.966	nu star (bias corrected)	3.6
Mean (detects)	2654		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2323
Maximum	13000	Median	188.8
SD	4525	CV	1.948
k hat (MLE)	0.205	k star (bias corrected MLE)	0.211
Theta hat (MLE)	11334	Theta star (bias corrected MLE)	10986
nu hat (MLE)	3.279	nu star (bias corrected)	3.383
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (3.38, α)	0.494	Adjusted Chi Square Value (3.38, β)	0.289
95% Gamma Approximate UCL (use when n>=50)	15895	95% Gamma Adjusted UCL (use when n<50)	27143

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2323	SD (KM)	4233
Variance (KM)	17918549	SE of Mean (KM)	1617
k hat (KM)	0.301	k star (KM)	0.272
nu hat (KM)	4.818	nu star (KM)	4.344
theta hat (KM)	7714	theta star (KM)	8555
80% gamma percentile (KM)	3466	90% gamma percentile (KM)	6925
95% gamma percentile (KM)	10965	99% gamma percentile (KM)	21601

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.34, α)	0.862	Adjusted Chi Square Value (4.34, β)	0.542
95% Gamma Approximate KM-UCL (use when n>=50)	11703	95% Gamma Adjusted KM-UCL (use when n<50)	18636

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2323	Mean in Log Scale	4.442
SD in Original Scale	4525	SD in Log Scale	4.041
95% t UCL (assumes normality of ROS data)	5354	95% Percentile Bootstrap UCL	5187
95% BCA Bootstrap UCL	6376	95% Bootstrap t UCL	25624
95% H-UCL (Log ROS)	2.876E+13		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.799	KM Geo Mean	121.4
KM SD (logged)	3.202	95% Critical H Value (KM-Log)	9.594
KM Standard Error of Mean (logged)	1.223	95% H-UCL (KM -Log)	2.262E+9
KM SD (logged)	3.202	95% Critical H Value (KM-Log)	9.594
KM Standard Error of Mean (logged)	1.223		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2323	Mean in Log Scale	4.713
SD in Original Scale	4525	SD in Log Scale	3.557
95% t UCL (Assumes normality)	5354	95% H-Stat UCL	9.950E+10

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	25240	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	18636

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	30	Minimum Non-Detect	5.1
Maximum Detect	5200	Maximum Non-Detect	5.1
Variance Detects	3550527	Percent Non-Detects	12.5%
Mean Detects	1099	SD Detects	1884
Median Detects	175	CV Detects	1.715
Skewness Detects	2.259	Kurtosis Detects	5.235
Mean of Logged Detects	5.62	SD of Logged Detects	1.885

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.656	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.308	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	962	KM Standard Error of Mean	638.3
KM SD	1671	95% KM (BCA) UCL	2080
95% KM (t) UCL	2171	95% KM (Percentile Bootstrap) UCL	2079
95% KM (z) UCL	2012	95% KM Bootstrap t UCL	7768
90% KM Chebyshev UCL	2877	95% KM Chebyshev UCL	3744
97.5% KM Chebyshev UCL	4948	99% KM Chebyshev UCL	7313

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.434	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.243	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.329	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.465	k star (bias corrected MLE)	0.361
Theta hat (MLE)	2363	Theta star (bias corrected MLE)	3044
nu hat (MLE)	6.509	nu star (bias corrected)	5.053
Mean (detects)	1099		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	961.4
Maximum	5200	Median	125
SD	1787	CV	1.859
k hat (MLE)	0.277	k star (bias corrected MLE)	0.256
Theta hat (MLE)	3476	Theta star (bias corrected MLE)	3752
nu hat (MLE)	4.425	nu star (bias corrected)	4.099
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (4.10, α)	0.761	Adjusted Chi Square Value (4.10, β)	0.47
95% Gamma Approximate UCL (use when n>=50)	5177	95% Gamma Adjusted UCL (use when n<50)	8390

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	962	SD (KM)	1671
Variance (KM)	2793707	SE of Mean (KM)	638.3
k hat (KM)	0.331	k star (KM)	0.29
nu hat (KM)	5.3	nu star (KM)	4.646
theta hat (KM)	2904	theta star (KM)	3313
80% gamma percentile (KM)	1463	90% gamma percentile (KM)	2848
95% gamma percentile (KM)	4447	99% gamma percentile (KM)	8619

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.65, α)	0.992	Adjusted Chi Square Value (4.65, β)	0.636
95% Gamma Approximate KM-UCL (use when n>=50)	4504	95% Gamma Adjusted KM-UCL (use when n<50)	7028

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	961.7	Mean in Log Scale	5.028
SD in Original Scale	1787	SD in Log Scale	2.42
95% t UCL (assumes normality of ROS data)	2159	95% Percentile Bootstrap UCL	2054
95% BCA Bootstrap UCL	2801	95% Bootstrap t UCL	7776
95% H-UCL (Log ROS)	2333292		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.121	KM Geo Mean	167.5
KM SD (logged)	2.1	95% Critical H Value (KM-Log)	6.417
KM Standard Error of Mean (logged)	0.802	95% H-UCL (KM -Log)	247086
KM SD (logged)	2.1	95% Critical H Value (KM-Log)	6.417
KM Standard Error of Mean (logged)	0.802		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	961.7	Mean in Log Scale	5.035
SD in Original Scale	1787	SD in Log Scale	2.406
95% t UCL (Assumes normality)	2159	95% H-Stat UCL	2108489

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	7768	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	7028

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	15	Minimum Non-Detect	850
Maximum Detect	5200	Maximum Non-Detect	850
Variance Detects	3657687	Percent Non-Detects	12.5%
Mean Detects	953.1	SD Detects	1913
Median Detects	63	CV Detects	2.007
Skewness Detects	2.439	Kurtosis Detects	6.055
Mean of Logged Detects	4.995	SD of Logged Detects	2.12

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.584	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.364	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	843.3	KM Standard Error of Mean	642.3
KM SD	1682	95% KM (BCA) UCL	2025
95% KM (t) UCL	2060	95% KM (Percentile Bootstrap) UCL	2003
95% KM (z) UCL	1900	95% KM Bootstrap t UCL	16786
90% KM Chebyshev UCL	2770	95% KM Chebyshev UCL	3643
97.5% KM Chebyshev UCL	4855	99% KM Chebyshev UCL	7234

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.636	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.774	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.28	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.359	k star (bias corrected MLE)	0.3
Theta hat (MLE)	2654	Theta star (bias corrected MLE)	3172
nu hat (MLE)	5.027	nu star (bias corrected)	4.206
Mean (detects)	953.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	834
Maximum	5200	Median	54.5
SD	1802	CV	2.161
k hat (MLE)	0.243	k star (bias corrected MLE)	0.235
Theta hat (MLE)	3427	Theta star (bias corrected MLE)	3542
nu hat (MLE)	3.894	nu star (bias corrected)	3.767
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (3.77, α)	0.632	Adjusted Chi Square Value (3.77, β)	0.38
95% Gamma Approximate UCL (use when n>=50)	4972	95% Gamma Adjusted UCL (use when n<50)	8260

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	843.3	SD (KM)	1682
Variance (KM)	2828419	SE of Mean (KM)	642.3
k hat (KM)	0.251	k star (KM)	0.24
nu hat (KM)	4.023	nu star (KM)	3.848
theta hat (KM)	3354	theta star (KM)	3507
80% gamma percentile (KM)	1207	90% gamma percentile (KM)	2538
95% gamma percentile (KM)	4129	99% gamma percentile (KM)	8389

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.85, α)	0.662	Adjusted Chi Square Value (3.85, β)	0.401
95% Gamma Approximate KM-UCL (use when n>=50)	4898	95% Gamma Adjusted KM-UCL (use when n<50)	8089

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.228	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	841.4	Mean in Log Scale	4.881
SD in Original Scale	1799	SD in Log Scale	1.989
95% t UCL (assumes normality of ROS data)	2046	95% Percentile Bootstrap UCL	1986
95% BCA Bootstrap UCL	2670	95% Bootstrap t UCL	21715
95% H-UCL (Log ROS)	93537		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.856	KM Geo Mean	128.5
KM SD (logged)	1.899	95% Critical H Value (KM-Log)	5.849
KM Standard Error of Mean (logged)	0.737	95% H-UCL (KM -Log)	51911
KM SD (logged)	1.899	95% Critical H Value (KM-Log)	5.849
KM Standard Error of Mean (logged)	0.737		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	887.1	Mean in Log Scale	5.127
SD in Original Scale	1780	SD in Log Scale	1.998
95% t UCL (Assumes normality)	2080	95% H-Stat UCL	126688

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	16786	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	8089

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	10	Mean	1528
Maximum	8000	Median	268.5
SD	2788	Std. Error of Mean	985.6
Coefficient of Variation	1.825	Skewness	2.277

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.632	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.372	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3395	95% Adjusted-CLT UCL (Chen-1995)	3997
		95% Modified-t UCL (Johnson-1978)	3527

Gamma GOF Test

A-D Test Statistic	0.433	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.784	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.234	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.314	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.373	k star (bias corrected MLE)	0.317
Theta hat (MLE)	4094	Theta star (bias corrected MLE)	4826
nu hat (MLE)	5.97	nu star (bias corrected)	5.065
MLE Mean (bias corrected)	1528	MLE Sd (bias corrected)	2715
		Approximate Chi Square Value (0.05)	1.182
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	0.778

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	6544	95% Adjusted Gamma UCL (use when n<50)	9951

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.303	Mean of logged Data	5.548
Maximum of Logged Data	8.987	SD of logged Data	2.246

Assuming Lognormal Distribution

95% H-UCL	1055804	90% Chebyshev (MVUE) UCL	5209
95% Chebyshev (MVUE) UCL	6834	97.5% Chebyshev (MVUE) UCL	9090
99% Chebyshev (MVUE) UCL	13522		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3149	95% Jackknife UCL	3395
95% Standard Bootstrap UCL	3064	95% Bootstrap-t UCL	16826
95% Hall's Bootstrap UCL	12071	95% Percentile Bootstrap UCL	3288
95% BCA Bootstrap UCL	4074		
90% Chebyshev(Mean, Sd) UCL	4484	95% Chebyshev(Mean, Sd) UCL	5824
97.5% Chebyshev(Mean, Sd) UCL	7682	99% Chebyshev(Mean, Sd) UCL	11334

Suggested UCL to Use

95% Adjusted Gamma UCL	9951

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	3	Number of Non-Detects	5
Number of Distinct Detects	3	Number of Distinct Non-Detects	5
Minimum Detect	21	Minimum Non-Detect	25
Maximum Detect	1100	Maximum Non-Detect	1700
Variance Detects	341890	Percent Non-Detects	62.5%
Mean Detects	430.3	SD Detects	584.7
Median Detects	170	CV Detects	1.359
Skewness Detects	1.606	Kurtosis Detects	N/A
Mean of Logged Detects	5.061	SD of Logged Detects	1.98

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.339	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	196.4	KM Standard Error of Mean	172.4
KM SD	372.4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	523.1	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	480	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	713.7	95% KM Chebyshev UCL	947.9
97.5% KM Chebyshev UCL	1273	99% KM Chebyshev UCL	1912

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.614	k star (bias corrected MLE)	N/A
Theta hat (MLE)	701.2	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.682	nu star (bias corrected)	N/A
Mean (detects)	430.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	161.4
Maximum	1100	Median	0.01
SD	383.8	CV	2.378
k hat (MLE)	0.129	k star (bias corrected MLE)	0.164
Theta hat (MLE)	1247	Theta star (bias corrected MLE)	982.7
nu hat (MLE)	2.071	nu star (bias corrected)	2.628
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (2.63, α)	0.271	Adjusted Chi Square Value (2.63, β)	0.157
95% Gamma Approximate UCL (use when n>=50)	1563	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	196.4	SD (KM)	372.4
Variance (KM)	138717	SE of Mean (KM)	172.4
k hat (KM)	0.278	k star (KM)	0.257
nu hat (KM)	4.45	nu star (KM)	4.115
theta hat (KM)	706.2	theta star (KM)	763.8
80% gamma percentile (KM)	288.1	90% gamma percentile (KM)	588.3
95% gamma percentile (KM)	942.8	99% gamma percentile (KM)	1883

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.11, α)	0.768	Adjusted Chi Square Value (4.11, β)	0.474
95% Gamma Approximate KM-UCL (use when n>=50)	1053	95% Gamma Adjusted KM-UCL (use when n<50)	1705

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.999	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	175.7	Mean in Log Scale	3.818
SD in Original Scale	377.1	SD in Log Scale	1.502
95% t UCL (assumes normality of ROS data)	428.3	95% Percentile Bootstrap UCL	432.6
95% BCA Bootstrap UCL	578.1	95% Bootstrap t UCL	7373
95% H-UCL (Log ROS)	2079		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.909	KM Geo Mean	49.84
KM SD (logged)	1.455	95% Critical H Value (KM-Log)	4.617
KM Standard Error of Mean (logged)	0.673	95% H-UCL (KM -Log)	1818
KM SD (logged)	1.455	95% Critical H Value (KM-Log)	4.617
KM Standard Error of Mean (logged)	0.673		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	275.3	Mean in Log Scale	4.104
SD in Original Scale	440.2	SD in Log Scale	1.9
95% t UCL (Assumes normality)	570.2	95% H-Stat UCL	24583

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	523.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	4	Number of Non-Detects	4
Number of Distinct Detects	4	Number of Distinct Non-Detects	4
Minimum Detect	15	Minimum Non-Detect	0.93
Maximum Detect	920	Maximum Non-Detect	630
Variance Detects	171258	Percent Non-Detects	50%
Mean Detects	329.5	SD Detects	413.8
Median Detects	191.5	CV Detects	1.256
Skewness Detects	1.485	Kurtosis Detects	1.922
Mean of Logged Detects	4.89	SD of Logged Detects	1.787

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.269	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	173.4	KM Standard Error of Mean	124.1
KM SD	300.9	95% KM (BCA) UCL	N/A
95% KM (t) UCL	408.5	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	377.5	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	545.7	95% KM Chebyshev UCL	714.3
97.5% KM Chebyshev UCL	948.3	99% KM Chebyshev UCL	1408

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.212	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.674	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.209	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.407	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.67	k star (bias corrected MLE)	0.334
Theta hat (MLE)	491.9	Theta star (bias corrected MLE)	986.1
nu hat (MLE)	5.359	nu star (bias corrected)	2.673
Mean (detects)	329.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	164.8
Maximum	920	Median	7.505
SD	323.1	CV	1.961
k hat (MLE)	0.154	k star (bias corrected MLE)	0.18
Theta hat (MLE)	1068	Theta star (bias corrected MLE)	916.6
nu hat (MLE)	2.468	nu star (bias corrected)	2.876
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (2.88, α)	0.337	Adjusted Chi Square Value (2.88, β)	0.193
95% Gamma Approximate UCL (use when n>=50)	1408	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	173.4	SD (KM)	300.9
Variance (KM)	90541	SE of Mean (KM)	124.1
k hat (KM)	0.332	k star (KM)	0.291
nu hat (KM)	5.316	nu star (KM)	4.656
theta hat (KM)	522	theta star (KM)	596
80% gamma percentile (KM)	263.9	90% gamma percentile (KM)	513.4
95% gamma percentile (KM)	801.2	99% gamma percentile (KM)	1552

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.66, α)	0.997	Adjusted Chi Square Value (4.66, β)	0.639
95% Gamma Approximate KM-UCL (use when n>=50)	810.2	95% Gamma Adjusted KM-UCL (use when n<50)	1263

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.985	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	167.2	Mean in Log Scale	3.084
SD in Original Scale	321.7	SD in Log Scale	2.324
95% t UCL (assumes normality of ROS data)	382.7	95% Percentile Bootstrap UCL	357.5
95% BCA Bootstrap UCL	478.8	95% Bootstrap t UCL	2204
95% H-UCL (Log ROS)	160643		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.678	KM Geo Mean	14.56
KM SD (logged)	2.684	95% Critical H Value (KM-Log)	8.092
KM Standard Error of Mean (logged)	1.154	95% H-UCL (KM -Log)	1958360
KM SD (logged)	2.684	95% Critical H Value (KM-Log)	8.092
KM Standard Error of Mean (logged)	1.154		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	205.4	Mean in Log Scale	3.46
SD in Original Scale	318.4	SD in Log Scale	2.62
95% t UCL (Assumes normality)	418.7	95% H-Stat UCL	2469624

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	408.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	5	Number of Non-Detects	3
Number of Distinct Detects	5	Number of Distinct Non-Detects	3
Minimum Detect	17	Minimum Non-Detect	9.8
Maximum Detect	3100	Maximum Non-Detect	670
Variance Detects	1706327	Percent Non-Detects	37.5%
Mean Detects	836.8	SD Detects	1306
Median Detects	205	CV Detects	1.561
Skewness Detects	1.923	Kurtosis Detects	3.697
Mean of Logged Detects	5.328	SD of Logged Detects	2.122

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.733	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.305	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	532.5	KM Standard Error of Mean	397.1
KM SD	1004	95% KM (BCA) UCL	1170
95% KM (t) UCL	1285	95% KM (Percentile Bootstrap) UCL	1201
95% KM (z) UCL	1186	95% KM Bootstrap t UCL	5524
90% KM Chebyshev UCL	1724	95% KM Chebyshev UCL	2263
97.5% KM Chebyshev UCL	3012	99% KM Chebyshev UCL	4484

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.267	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.717	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.373	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.459	k star (bias corrected MLE)	0.317
Theta hat (MLE)	1822	Theta star (bias corrected MLE)	2639
nu hat (MLE)	4.594	nu star (bias corrected)	3.171
Mean (detects)	836.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	523
Maximum	3100	Median	29.5
SD	1078	CV	2.062
k hat (MLE)	0.163	k star (bias corrected MLE)	0.185
Theta hat (MLE)	3208	Theta star (bias corrected MLE)	2823
nu hat (MLE)	2.609	nu star (bias corrected)	2.964
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (2.96, α)	0.362	Adjusted Chi Square Value (2.96, β)	0.208
95% Gamma Approximate UCL (use when n>=50)	4285	95% Gamma Adjusted UCL (use when n<50)	7460

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	532.5	SD (KM)	1004
Variance (KM)	1008342	SE of Mean (KM)	397.1
k hat (KM)	0.281	k star (KM)	0.259
nu hat (KM)	4.5	nu star (KM)	4.146
theta hat (KM)	1893	theta star (KM)	2055
80% gamma percentile (KM)	783	90% gamma percentile (KM)	1594
95% gamma percentile (KM)	2550	99% gamma percentile (KM)	5083

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.15, α)	0.78	Adjusted Chi Square Value (4.15, β)	0.483
95% Gamma Approximate KM-UCL (use when n>=50)	2830	95% Gamma Adjusted KM-UCL (use when n<50)	4571

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	525.2	Mean in Log Scale	3.763
SD in Original Scale	1077	SD in Log Scale	2.783
95% t UCL (assumes normality of ROS data)	1247	95% Percentile Bootstrap UCL	1197
95% BCA Bootstrap UCL	1498	95% Bootstrap t UCL	8134
95% H-UCL (Log ROS)	13905239		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.312	KM Geo Mean	74.62
KM SD (logged)	2.055	95% Critical H Value (KM-Log)	6.29
KM Standard Error of Mean (logged)	0.831	95% H-UCL (KM -Log)	81423
KM SD (logged)	2.055	95% Critical H Value (KM-Log)	6.29
KM Standard Error of Mean (logged)	0.831		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	566.2	Mean in Log Scale	4.469
SD in Original Scale	1061	SD in Log Scale	2.374
95% t UCL (Assumes normality)	1277	95% H-Stat UCL	933732

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1285

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	70.5	Minimum Non-Detect	3.6
Maximum Detect	4200	Maximum Non-Detect	3.6
Variance Detects	2295279	Percent Non-Detects	12.5%
Mean Detects	773.8	SD Detects	1515
Median Detects	230	CV Detects	1.958
Skewness Detects	2.615	Kurtosis Detects	6.876
Mean of Logged Detects	5.597	SD of Logged Detects	1.354

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.523	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.457	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	677.5	KM Standard Error of Mean	510.4
KM SD	1337	95% KM (BCA) UCL	1690
95% KM (t) UCL	1645	95% KM (Percentile Bootstrap) UCL	1665
95% KM (z) UCL	1517	95% KM Bootstrap t UCL	8574
90% KM Chebyshev UCL	2209	95% KM Chebyshev UCL	2902
97.5% KM Chebyshev UCL	3865	99% KM Chebyshev UCL	5756

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.977	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.746	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.364	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.326	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.588	k star (bias corrected MLE)	0.431
Theta hat (MLE)	1316	Theta star (bias corrected MLE)	1795
nu hat (MLE)	8.229	nu star (bias corrected)	6.036
Mean (detects)	773.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	677.1
Maximum	4200	Median	185
SD	1429	CV	2.111
k hat (MLE)	0.312	k star (bias corrected MLE)	0.278
Theta hat (MLE)	2170	Theta star (bias corrected MLE)	2433
nu hat (MLE)	4.992	nu star (bias corrected)	4.453
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (4.45, α)	0.909	Adjusted Chi Square Value (4.45, β)	0.575
95% Gamma Approximate UCL (use when n>=50)	3319	95% Gamma Adjusted UCL (use when n<50)	5245

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	677.5	SD (KM)	1337
Variance (KM)	1786339	SE of Mean (KM)	510.4
k hat (KM)	0.257	k star (KM)	0.244
nu hat (KM)	4.111	nu star (KM)	3.903
theta hat (KM)	2637	theta star (KM)	2777
80% gamma percentile (KM)	975.2	90% gamma percentile (KM)	2037
95% gamma percentile (KM)	3303	99% gamma percentile (KM)	6686

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.90, α)	0.684	Adjusted Chi Square Value (3.90, β)	0.416
95% Gamma Approximate KM-UCL (use when n>=50)	3867	95% Gamma Adjusted KM-UCL (use when n<50)	6360

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.859	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.25	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	678.4	Mean in Log Scale	5.197
SD in Original Scale	1428	SD in Log Scale	1.689
95% t UCL (assumes normality of ROS data)	1635	95% Percentile Bootstrap UCL	1660
95% BCA Bootstrap UCL	2183	95% Bootstrap t UCL	8755
95% H-UCL (Log ROS)	21656		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.057	KM Geo Mean	157.2
KM SD (logged)	1.847	95% Critical H Value (KM-Log)	5.704
KM Standard Error of Mean (logged)	0.705	95% H-UCL (KM -Log)	46472
KM SD (logged)	1.847	95% Critical H Value (KM-Log)	5.704
KM Standard Error of Mean (logged)	0.705		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	677.3	Mean in Log Scale	4.971
SD in Original Scale	1429	SD in Log Scale	2.17
95% t UCL (Assumes normality)	1634	95% H-Stat UCL	345003

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	2902

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	1700	Mean	6188
Maximum	8400	Median	7050
SD	2238	Std. Error of Mean	791.1
Coefficient of Variation	0.362	Skewness	-1.294

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.267	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7686	95% Adjusted-CLT UCL (Chen-1995)	7102
		95% Modified-t UCL (Johnson-1978)	7626

Gamma GOF Test

A-D Test Statistic	0.771	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.719	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.294	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.507	k star (bias corrected MLE)	3.525
Theta hat (MLE)	1124	Theta star (bias corrected MLE)	1755
nu hat (MLE)	88.11	nu star (bias corrected)	56.4
MLE Mean (bias corrected)	6188	MLE Sd (bias corrected)	3296
		Approximate Chi Square Value (0.05)	40.14
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	36.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8694	95% Adjusted Gamma UCL (use when n<50)	9510

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.746	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.438	Mean of logged Data	8.637
Maximum of Logged Data	9.036	SD of logged Data	0.528

Assuming Lognormal Distribution

95% H-UCL	10468	90% Chebyshev (MVUE) UCL	9957
95% Chebyshev (MVUE) UCL	11588	97.5% Chebyshev (MVUE) UCL	13852
99% Chebyshev (MVUE) UCL	18298		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7489	95% Jackknife UCL	7686
95% Standard Bootstrap UCL	7399	95% Bootstrap-t UCL	7352
95% Hall's Bootstrap UCL	7194	95% Percentile Bootstrap UCL	7313
95% BCA Bootstrap UCL	7175		
90% Chebyshev(Mean, Sd) UCL	8561	95% Chebyshev(Mean, Sd) UCL	9636
97.5% Chebyshev(Mean, Sd) UCL	11128	99% Chebyshev(Mean, Sd) UCL	14059

Suggested UCL to Use

95% Student's-t UCL	7686

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.59	Minimum Non-Detect	0.33
Maximum Detect	707	Maximum Non-Detect	0.33
Variance Detects	69968	Percent Non-Detects	12.5%
Mean Detects	107.5	SD Detects	264.5
Median Detects	2.1	CV Detects	2.461
Skewness Detects	2.639	Kurtosis Detects	6.972
Mean of Logged Detects	1.794	SD of Logged Detects	2.573

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.481	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.482	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	94.11	KM Standard Error of Mean	88.52
KM SD	231.8	95% KM (BCA) UCL	268.2
95% KM (t) UCL	261.8	95% KM (Percentile Bootstrap) UCL	268
95% KM (z) UCL	239.7	95% KM Bootstrap t UCL	3816
90% KM Chebyshev UCL	359.7	95% KM Chebyshev UCL	480
97.5% KM Chebyshev UCL	646.9	99% KM Chebyshev UCL	974.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.913	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.805	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.329	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.339	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.247	k star (bias corrected MLE)	0.236
Theta hat (MLE)	435.6	Theta star (bias corrected MLE)	455
nu hat (MLE)	3.455	nu star (bias corrected)	3.308
Mean (detects)	107.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	94.07
Maximum	707	Median	1.625
SD	247.8	CV	2.635
k hat (MLE)	0.206	k star (bias corrected MLE)	0.212
Theta hat (MLE)	456	Theta star (bias corrected MLE)	443.2
nu hat (MLE)	3.301	nu star (bias corrected)	3.396
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (3.40, α)	0.499	Adjusted Chi Square Value (3.40, β)	0.292
95% Gamma Approximate UCL (use when n>=50)	640.4	95% Gamma Adjusted UCL (use when n<50)	1093

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	94.11	SD (KM)	231.8
Variance (KM)	53733	SE of Mean (KM)	88.52
k hat (KM)	0.165	k star (KM)	0.186
nu hat (KM)	2.637	nu star (KM)	2.981
theta hat (KM)	571	theta star (KM)	505
80% gamma percentile (KM)	119.2	90% gamma percentile (KM)	284.2
95% gamma percentile (KM)	493.7	99% gamma percentile (KM)	1077

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (2.98, α)	0.367	Adjusted Chi Square Value (2.98, β)	0.211
95% Gamma Approximate KM-UCL (use when n>=50)	764.6	95% Gamma Adjusted KM-UCL (use when n<50)	1331

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.23	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	94.07	Mean in Log Scale	1.016
SD in Original Scale	247.8	SD in Log Scale	3.243
95% t UCL (assumes normality of ROS data)	260.1	95% Percentile Bootstrap UCL	267.8
95% BCA Bootstrap UCL	356.1	95% Bootstrap t UCL	3761
95% H-UCL (Log ROS)	78056383		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.431	KM Geo Mean	4.182
KM SD (logged)	2.426	95% Critical H Value (KM-Log)	7.35
KM Standard Error of Mean (logged)	0.926	95% H-UCL (KM -Log)	66990
KM SD (logged)	2.426	95% Critical H Value (KM-Log)	7.35
KM Standard Error of Mean (logged)	0.926		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	94.09	Mean in Log Scale	1.344
SD in Original Scale	247.8	SD in Log Scale	2.7
95% t UCL (Assumes normality)	260.1	95% H-Stat UCL	592752

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	3816	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	1331

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	3.6	Mean	33.06
Maximum	70.5	Median	21
SD	27.09	Std. Error of Mean	9.578
Coefficient of Variation	0.819	Skewness	0.587

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	51.21	95% Adjusted-CLT UCL (Chen-1995)	50.94
		95% Modified-t UCL (Johnson-1978)	51.54

Gamma GOF Test

A-D Test Statistic	0.343	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.178	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.399	k star (bias corrected MLE)	0.957
Theta hat (MLE)	23.64	Theta star (bias corrected MLE)	34.53
nu hat (MLE)	22.38	nu star (bias corrected)	15.32
MLE Mean (bias corrected)	33.06	MLE Sd (bias corrected)	33.79
		Approximate Chi Square Value (0.05)	7.484
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	6.152

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	67.68	95% Adjusted Gamma UCL (use when n<50)	82.33

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.281	Mean of logged Data	3.1
Maximum of Logged Data	4.256	SD of logged Data	1.057

Assuming Lognormal Distribution

95% H-UCL	161.2	90% Chebyshev (MVUE) UCL	75.76
95% Chebyshev (MVUE) UCL	94.07	97.5% Chebyshev (MVUE) UCL	119.5
99% Chebyshev (MVUE) UCL	169.4		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	48.82	95% Jackknife UCL	51.21
95% Standard Bootstrap UCL	47.97	95% Bootstrap-t UCL	57.36
95% Hall's Bootstrap UCL	47.72	95% Percentile Bootstrap UCL	48.75
95% BCA Bootstrap UCL	49.13		
90% Chebyshev(Mean, Sd) UCL	61.8	95% Chebyshev(Mean, Sd) UCL	74.81
97.5% Chebyshev(Mean, Sd) UCL	92.87	99% Chebyshev(Mean, Sd) UCL	128.4

Suggested UCL to Use

95% Student's-t UCL 51.21

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	55	Mean	572.1
Maximum	1800	Median	350
SD	622.1	Std. Error of Mean	219.9
Coefficient of Variation	1.087	Skewness	1.254

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	988.8	95% Adjusted-CLT UCL (Chen-1995)	1038
		95% Modified-t UCL (Johnson-1978)	1005

Gamma GOF Test

A-D Test Statistic	0.301	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.191	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.303	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.865	k star (bias corrected MLE)	0.624
Theta hat (MLE)	661.4	Theta star (bias corrected MLE)	916.9
nu hat (MLE)	13.84	nu star (bias corrected)	9.983
MLE Mean (bias corrected)	572.1	MLE Sd (bias corrected)	724.3
		Approximate Chi Square Value (0.05)	3.931
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	3.031

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1453	95% Adjusted Gamma UCL (use when n<50)	1884

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.169	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.007	Mean of logged Data	5.67
Maximum of Logged Data	7.496	SD of logged Data	1.361

Assuming Lognormal Distribution

95% H-UCL	6914	90% Chebyshev (MVUE) UCL	1512
95% Chebyshev (MVUE) UCL	1918	97.5% Chebyshev (MVUE) UCL	2483
99% Chebyshev (MVUE) UCL	3592		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	933.9	95% Jackknife UCL	988.8
95% Standard Bootstrap UCL	918.3	95% Bootstrap-t UCL	1191
95% Hall's Bootstrap UCL	1238	95% Percentile Bootstrap UCL	934
95% BCA Bootstrap UCL	994.4		
90% Chebyshev(Mean, Sd) UCL	1232	95% Chebyshev(Mean, Sd) UCL	1531
97.5% Chebyshev(Mean, Sd) UCL	1946	99% Chebyshev(Mean, Sd) UCL	2760

Suggested UCL to Use

95% Student's-t UCL	988.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.21	Minimum Non-Detect	0.16
Maximum Detect	30	Maximum Non-Detect	0.16
Variance Detects	126	Percent Non-Detects	12.5%
Mean Detects	6.744	SD Detects	11.23
Median Detects	1.4	CV Detects	1.665
Skewness Detects	1.939	Kurtosis Detects	3.429
Mean of Logged Detects	0.498	SD of Logged Detects	1.872

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.675	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.384	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.921	KM Standard Error of Mean	3.805
KM SD	9.963	95% KM (BCA) UCL	13
95% KM (t) UCL	13.13	95% KM (Percentile Bootstrap) UCL	12.63
95% KM (z) UCL	12.18	95% KM Bootstrap t UCL	87.7
90% KM Chebyshev UCL	17.34	95% KM Chebyshev UCL	22.51
97.5% KM Chebyshev UCL	29.68	99% KM Chebyshev UCL	43.78

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.578	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.759	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.298	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.329	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.457	k star (bias corrected MLE)	0.356
Theta hat (MLE)	14.77	Theta star (bias corrected MLE)	18.93
nu hat (MLE)	6.394	nu star (bias corrected)	4.987
Mean (detects)	6.744		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.903
Maximum	30	Median	0.92
SD	10.66	CV	1.806
k hat (MLE)	0.351	k star (bias corrected MLE)	0.303
Theta hat (MLE)	16.82	Theta star (bias corrected MLE)	19.5
nu hat (MLE)	5.615	nu star (bias corrected)	4.843
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (4.84, α)	1.08	Adjusted Chi Square Value (4.84, β)	0.701
95% Gamma Approximate UCL (use when n>=50)	26.46	95% Gamma Adjusted UCL (use when n<50)	40.77

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.921	SD (KM)	9.963
Variance (KM)	99.26	SE of Mean (KM)	3.805
k hat (KM)	0.353	k star (KM)	0.304
nu hat (KM)	5.651	nu star (KM)	4.865
theta hat (KM)	16.76	theta star (KM)	19.47
80% gamma percentile (KM)	9.111	90% gamma percentile (KM)	17.44
95% gamma percentile (KM)	26.97	99% gamma percentile (KM)	51.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.87, α)	1.091	Adjusted Chi Square Value (4.87, β)	0.709
95% Gamma Approximate KM-UCL (use when n>=50)	26.42	95% Gamma Adjusted KM-UCL (use when n<50)	40.65

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.903	Mean in Log Scale	-0.0823
SD in Original Scale	10.66	SD in Log Scale	2.387
95% t UCL (assumes normality of ROS data)	13.05	95% Percentile Bootstrap UCL	11.86
95% BCA Bootstrap UCL	14.78	95% Bootstrap t UCL	86.33
95% H-UCL (Log ROS)	10917		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.207	KM Geo Mean	1.23
KM SD (logged)	1.795	95% Critical H Value (KM-Log)	5.558
KM Standard Error of Mean (logged)	0.685	95% H-UCL (KM -Log)	267.3
KM SD (logged)	1.795	95% Critical H Value (KM-Log)	5.558
KM Standard Error of Mean (logged)	0.685		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.911	Mean in Log Scale	0.12
SD in Original Scale	10.66	SD in Log Scale	2.036
95% t UCL (Assumes normality)	13.05	95% H-Stat UCL	1090

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	87.7	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	40.65

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	3	Number of Non-Detects	5
Number of Distinct Detects	3	Number of Distinct Non-Detects	5
Minimum Detect	0.5	Minimum Non-Detect	0.26
Maximum Detect	1.4	Maximum Non-Detect	1.6
Variance Detects	0.207	Percent Non-Detects	62.5%
Mean Detects	0.913	SD Detects	0.454
Median Detects	0.84	CV Detects	0.498
Skewness Detects	0.707	Kurtosis Detects	N/A
Mean of Logged Detects	-0.177	SD of Logged Detects	0.515

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.563	KM Standard Error of Mean	0.191
KM SD	0.401	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.925	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.877	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.136	95% KM Chebyshev UCL	1.395
97.5% KM Chebyshev UCL	1.755	99% KM Chebyshev UCL	2.463

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	5.952	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.153	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	35.71	nu star (bias corrected)	N/A
Mean (detects)	0.913		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.419
Maximum	1.4	Median	0.29
SD	0.491	CV	1.172
k hat (MLE)	0.512	k star (bias corrected MLE)	0.403
Theta hat (MLE)	0.818	Theta star (bias corrected MLE)	1.038
nu hat (MLE)	8.189	nu star (bias corrected)	6.451
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (6.45, α)	1.875	Adjusted Chi Square Value (6.45, β)	1.317
95% Gamma Approximate UCL (use when n>=50)	1.441	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.563	SD (KM)	0.401
Variance (KM)	0.161	SE of Mean (KM)	0.191
k hat (KM)	1.97	k star (KM)	1.315
nu hat (KM)	31.52	nu star (KM)	21.03
theta hat (KM)	0.286	theta star (KM)	0.429
80% gamma percentile (KM)	0.884	90% gamma percentile (KM)	1.213
95% gamma percentile (KM)	1.535	99% gamma percentile (KM)	2.268

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (21.03, α)	11.62	Adjusted Chi Square Value (21.03, β)	9.895
95% Gamma Approximate KM-UCL (use when n>=50)	1.02	95% Gamma Adjusted KM-UCL (use when n<50)	1.198

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	1	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.53	Mean in Log Scale	-0.839
SD in Original Scale	0.405	SD in Log Scale	0.646
95% t UCL (assumes normality of ROS data)	0.801	95% Percentile Bootstrap UCL	0.77
95% BCA Bootstrap UCL	0.847	95% Bootstrap t UCL	1.296
95% H-UCL (Log ROS)	1.01		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.793	KM Geo Mean	0.452
KM SD (logged)	0.638	95% Critical H Value (KM-Log)	2.609
KM Standard Error of Mean (logged)	0.309	95% H-UCL (KM -Log)	1.04
KM SD (logged)	0.638	95% Critical H Value (KM-Log)	2.609
KM Standard Error of Mean (logged)	0.309		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.583	Mean in Log Scale	-0.846
SD in Original Scale	0.437	SD in Log Scale	0.896
95% t UCL (Assumes normality)	0.876	95% H-Stat UCL	1.879

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.925

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	8	Number of Distinct Observations	7
		Number of Missing Observations	1
Minimum	2.2	Mean	10.76
Maximum	24	Median	10.55
SD	7.469	Std. Error of Mean	2.641
Coefficient of Variation	0.694	Skewness	0.613

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15.76	95% Adjusted-CLT UCL (Chen-1995)	15.71
		95% Modified-t UCL (Johnson-1978)	15.85

Gamma GOF Test

A-D Test Statistic	0.238	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.195	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.297	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.01	k star (bias corrected MLE)	1.34
Theta hat (MLE)	5.351	Theta star (bias corrected MLE)	8.029
nu hat (MLE)	32.16	nu star (bias corrected)	21.43
MLE Mean (bias corrected)	10.76	MLE Sd (bias corrected)	9.293
		Approximate Chi Square Value (0.05)	11.92
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	10.17

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	19.35	95% Adjusted Gamma UCL (use when n<50)	22.68

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.788	Mean of logged Data	2.107
Maximum of Logged Data	3.178	SD of logged Data	0.848

Assuming Lognormal Distribution

95% H-UCL	31.43	90% Chebyshev (MVUE) UCL	21.37
95% Chebyshev (MVUE) UCL	26	97.5% Chebyshev (MVUE) UCL	32.43
99% Chebyshev (MVUE) UCL	45.05		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	15.1	95% Jackknife UCL	15.76
95% Standard Bootstrap UCL	14.82	95% Bootstrap-t UCL	16.95
95% Hall's Bootstrap UCL	16.58	95% Percentile Bootstrap UCL	14.99
95% BCA Bootstrap UCL	15.26		
90% Chebyshev(Mean, Sd) UCL	18.68	95% Chebyshev(Mean, Sd) UCL	22.27
97.5% Chebyshev(Mean, Sd) UCL	27.25	99% Chebyshev(Mean, Sd) UCL	37.03

Suggested UCL to Use

95% Student's-t UCL	15.76

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	12	Mean	790.7
Maximum	3300	Median	185.3
SD	1162	Std. Error of Mean	410.7
Coefficient of Variation	1.469	Skewness	1.767

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.744	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1569	95% Adjusted-CLT UCL (Chen-1995)	1740
		95% Modified-t UCL (Johnson-1978)	1612

Gamma GOF Test

A-D Test Statistic	0.411	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.768	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.265	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.31	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.469	k star (bias corrected MLE)	0.376
Theta hat (MLE)	1687	Theta star (bias corrected MLE)	2102
nu hat (MLE)	7.497	nu star (bias corrected)	6.019
MLE Mean (bias corrected)	790.7	MLE Sd (bias corrected)	1289
		Approximate Chi Square Value (0.05)	1.65
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	1.138

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2885	95% Adjusted Gamma UCL (use when n<50)	4180

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.485	Mean of logged Data	5.303
Maximum of Logged Data	8.102	SD of logged Data	2.005

Assuming Lognormal Distribution

95% H-UCL	158409	90% Chebyshev (MVUE) UCL	2773
95% Chebyshev (MVUE) UCL	3617	97.5% Chebyshev (MVUE) UCL	4787
99% Chebyshev (MVUE) UCL	7086		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1466	95% Jackknife UCL	1569
95% Standard Bootstrap UCL	1413	95% Bootstrap-t UCL	2875
95% Hall's Bootstrap UCL	4025	95% Percentile Bootstrap UCL	1453
95% BCA Bootstrap UCL	1723		
90% Chebyshev(Mean, Sd) UCL	2023	95% Chebyshev(Mean, Sd) UCL	2581
97.5% Chebyshev(Mean, Sd) UCL	3356	99% Chebyshev(Mean, Sd) UCL	4877

Suggested UCL to Use

95% Adjusted Gamma UCL	4180

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	0.38	Minimum Non-Detect	0.22
Maximum Detect	4.1	Maximum Non-Detect	0.225
Variance Detects	1.985	Percent Non-Detects	25%
Mean Detects	1.543	SD Detects	1.409
Median Detects	1.235	CV Detects	0.913
Skewness Detects	1.423	Kurtosis Detects	2.027
Mean of Logged Detects	0.0772	SD of Logged Detects	0.943

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.843	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.213	KM Standard Error of Mean	0.485
KM SD	1.253	95% KM (BCA) UCL	2.003
95% KM (t) UCL	2.132	95% KM (Percentile Bootstrap) UCL	2
95% KM (z) UCL	2.01	95% KM Bootstrap t UCL	2.8
90% KM Chebyshev UCL	2.668	95% KM Chebyshev UCL	3.327
97.5% KM Chebyshev UCL	4.242	99% KM Chebyshev UCL	6.039

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.321	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.707	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.337	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.547	k star (bias corrected MLE)	0.885
Theta hat (MLE)	0.998	Theta star (bias corrected MLE)	1.745
nu hat (MLE)	18.56	nu star (bias corrected)	10.62
Mean (detects)	1.543		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.16
Maximum	4.1	Median	0.59
SD	1.386	CV	1.195
k hat (MLE)	0.51	k star (bias corrected MLE)	0.402
Theta hat (MLE)	2.275	Theta star (bias corrected MLE)	2.885
nu hat (MLE)	8.159	nu star (bias corrected)	6.433
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (6.43, α)	1.865	Adjusted Chi Square Value (6.43, β)	1.309
95% Gamma Approximate UCL (use when n>=50)	4.001	95% Gamma Adjusted UCL (use when n<50)	5.699

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.213	SD (KM)	1.253
Variance (KM)	1.569	SE of Mean (KM)	0.485
k hat (KM)	0.937	k star (KM)	0.669
nu hat (KM)	14.99	nu star (KM)	10.7
theta hat (KM)	1.294	theta star (KM)	1.812
80% gamma percentile (KM)	1.996	90% gamma percentile (KM)	3.076
95% gamma percentile (KM)	4.195	99% gamma percentile (KM)	6.876

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.70, α)	4.386	Adjusted Chi Square Value (10.70, β)	3.423
95% Gamma Approximate KM-UCL (use when n>=50)	2.959	95% Gamma Adjusted KM-UCL (use when n<50)	3.792

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.182	Mean in Log Scale	-0.519
SD in Original Scale	1.365	SD in Log Scale	1.362
95% t UCL (assumes normality of ROS data)	2.097	95% Percentile Bootstrap UCL	1.964
95% BCA Bootstrap UCL	2.225	95% Bootstrap t UCL	2.811
95% H-UCL (Log ROS)	14.21		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.321	KM Geo Mean	0.726
KM SD (logged)	1.015	95% Critical H Value (KM-Log)	3.464
KM Standard Error of Mean (logged)	0.393	95% H-UCL (KM -Log)	4.59
KM SD (logged)	1.015	95% Critical H Value (KM-Log)	3.464
KM Standard Error of Mean (logged)	0.393		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.185	Mean in Log Scale	-0.491
SD in Original Scale	1.363	SD in Log Scale	1.32
95% t UCL (Assumes normality)	2.098	95% H-Stat UCL	12.22

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.132

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	4800	Mean	40581
Maximum	180000	Median	12625
SD	61017	Std. Error of Mean	21573
Coefficient of Variation	1.504	Skewness	2.167

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.66	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.351	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	81452	95% Adjusted-CLT UCL (Chen-1995)	93722
		95% Modified-t UCL (Johnson-1978)	84206

Gamma GOF Test

A-D Test Statistic	0.697	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.286	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.304	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.747	k star (bias corrected MLE)	0.55
Theta hat (MLE)	54325	Theta star (bias corrected MLE)	73755
nu hat (MLE)	11.95	nu star (bias corrected)	8.803
MLE Mean (bias corrected)	40581	MLE Sd (bias corrected)	54709
		Approximate Chi Square Value (0.05)	3.209
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	2.416

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	111340	95% Adjusted Gamma UCL (use when n<50)	147842

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.897	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.229	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.476	Mean of logged Data	9.809
Maximum of Logged Data	12.1	SD of logged Data	1.276

Assuming Lognormal Distribution

95% H-UCL	301779	90% Chebyshev (MVUE) UCL	84001
95% Chebyshev (MVUE) UCL	106038	97.5% Chebyshev (MVUE) UCL	136625
99% Chebyshev (MVUE) UCL	196707		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	76065	95% Jackknife UCL	81452
95% Standard Bootstrap UCL	73346	95% Bootstrap-t UCL	316197
95% Hall's Bootstrap UCL	258226	95% Percentile Bootstrap UCL	77556
95% BCA Bootstrap UCL	93731		
90% Chebyshev(Mean, Sd) UCL	105299	95% Chebyshev(Mean, Sd) UCL	134614
97.5% Chebyshev(Mean, Sd) UCL	175302	99% Chebyshev(Mean, Sd) UCL	255226

Suggested UCL to Use

95% Adjusted Gamma UCL	147842

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	2.9	Mean	2393
Maximum	13355	Median	205
SD	4595	Std. Error of Mean	1625
Coefficient of Variation	1.92	Skewness	2.469

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.607	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5471	95% Adjusted-CLT UCL (Chen-1995)	6581
		95% Modified-t UCL (Johnson-1978)	5708

Gamma GOF Test

A-D Test Statistic	0.359	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.796	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.253	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.317	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.306	k star (bias corrected MLE)	0.274
Theta hat (MLE)	7831	Theta star (bias corrected MLE)	8724
nu hat (MLE)	4.89	nu star (bias corrected)	4.39
MLE Mean (bias corrected)	2393	MLE Sd (bias corrected)	4569
		Approximate Chi Square Value (0.05)	0.881
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	0.555

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	11920	95% Adjusted Gamma UCL (use when n<50)	18921

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.145	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.065	Mean of logged Data	5.531
Maximum of Logged Data	9.5	SD of logged Data	2.764

Assuming Lognormal Distribution

95% H-UCL	68773685	90% Chebyshev (MVUE) UCL	12126
95% Chebyshev (MVUE) UCL	16051	97.5% Chebyshev (MVUE) UCL	21500
99% Chebyshev (MVUE) UCL	32202		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5066	95% Jackknife UCL	5471
95% Standard Bootstrap UCL	4850	95% Bootstrap-t UCL	17130
95% Hall's Bootstrap UCL	18344	95% Percentile Bootstrap UCL	5325
95% BCA Bootstrap UCL	6953		
90% Chebyshev(Mean, Sd) UCL	7267	95% Chebyshev(Mean, Sd) UCL	9474
97.5% Chebyshev(Mean, Sd) UCL	12538	99% Chebyshev(Mean, Sd) UCL	18557

Suggested UCL to Use

95% Adjusted Gamma UCL	18921

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	7
Minimum	980	Mean	3640
Maximum	6300	Median	3640

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - coarse fraction was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Lead - fine fraction

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	7
Minimum	1500	Mean	3400
Maximum	5300	Median	3400

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - fine fraction was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	7
Minimum	35	Mean	567.5
Maximum	1100	Median	567.5

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - total (calculated by fine/coarse fraction) was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	20	Mean	527.4
Maximum	2300	Median	310
SD	752.9	Std. Error of Mean	266.2
Coefficient of Variation	1.428	Skewness	2.317

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.683	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.347	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1032	95% Adjusted-CLT UCL (Chen-1995)	1198
		95% Modified-t UCL (Johnson-1978)	1068

Gamma GOF Test

A-D Test Statistic	0.329	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.305	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.685	k star (bias corrected MLE)	0.511
Theta hat (MLE)	770.4	Theta star (bias corrected MLE)	1032
nu hat (MLE)	10.95	nu star (bias corrected)	8.18
MLE Mean (bias corrected)	527.4	MLE Sd (bias corrected)	737.7
		Approximate Chi Square Value (0.05)	2.84
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	2.107

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1519	95% Adjusted Gamma UCL (use when n<50)	2048

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.996	Mean of logged Data	5.383
Maximum of Logged Data	7.741	SD of logged Data	1.536

Assuming Lognormal Distribution

95% H-UCL	11758	90% Chebyshev (MVUE) UCL	1463
95% Chebyshev (MVUE) UCL	1875	97.5% Chebyshev (MVUE) UCL	2446
99% Chebyshev (MVUE) UCL	3567		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	965.3	95% Jackknife UCL	1032
95% Standard Bootstrap UCL	936.1	95% Bootstrap-t UCL	1766
95% Hall's Bootstrap UCL	2572	95% Percentile Bootstrap UCL	988.8
95% BCA Bootstrap UCL	1130		
90% Chebyshev(Mean, Sd) UCL	1326	95% Chebyshev(Mean, Sd) UCL	1688
97.5% Chebyshev(Mean, Sd) UCL	2190	99% Chebyshev(Mean, Sd) UCL	3176

Suggested UCL to Use

95% Adjusted Gamma UCL	2048

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	0.0095	Mean	0.549
Maximum	3.2	Median	0.15
SD	1.085	Std. Error of Mean	0.384
Coefficient of Variation	1.975	Skewness	2.692

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.545	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.38	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1.276	95% Adjusted-CLT UCL (Chen-1995)	1.571
		95% Modified-t UCL (Johnson-1978)	1.337

Gamma GOF Test

A-D Test Statistic	0.588	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.764	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.301	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.309	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.488	k star (bias corrected MLE)	0.388
Theta hat (MLE)	1.125	Theta star (bias corrected MLE)	1.414
nu hat (MLE)	7.812	nu star (bias corrected)	6.216
MLE Mean (bias corrected)	0.549	MLE Sd (bias corrected)	0.882
		Approximate Chi Square Value (0.05)	1.751
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	1.219

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1.95	95% Adjusted Gamma UCL (use when n<50)	2.802

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.656	Mean of logged Data	-1.905
Maximum of Logged Data	1.163	SD of logged Data	1.733

Assuming Lognormal Distribution

95% H-UCL	22.67	90% Chebyshev (MVUE) UCL	1.345
95% Chebyshev (MVUE) UCL	1.738	97.5% Chebyshev (MVUE) UCL	2.284
99% Chebyshev (MVUE) UCL	3.355		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1.18	95% Jackknife UCL	1.276
95% Standard Bootstrap UCL	1.139	95% Bootstrap-t UCL	7.655
95% Hall's Bootstrap UCL	4.843	95% Percentile Bootstrap UCL	1.275
95% BCA Bootstrap UCL	1.416		
90% Chebyshev(Mean, Sd) UCL	1.7	95% Chebyshev(Mean, Sd) UCL	2.222
97.5% Chebyshev(Mean, Sd) UCL	2.945	99% Chebyshev(Mean, Sd) UCL	4.367

Suggested UCL to Use

95% Adjusted Gamma UCL	2.802

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	6	Mean	76.63
Maximum	310	Median	26.5
SD	103.3	Std. Error of Mean	36.51
Coefficient of Variation	1.348	Skewness	2.019

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.725	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.303	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	145.8	95% Adjusted-CLT UCL (Chen-1995)	164.5
		95% Modified-t UCL (Johnson-1978)	150.1

Gamma GOF Test

A-D Test Statistic	0.408	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.257	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.304	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.777	k star (bias corrected MLE)	0.569
Theta hat (MLE)	98.62	Theta star (bias corrected MLE)	134.7
nu hat (MLE)	12.43	nu star (bias corrected)	9.103
MLE Mean (bias corrected)	76.63	MLE Sd (bias corrected)	101.6
		Approximate Chi Square Value (0.05)	3.389
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	2.569

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	205.8	95% Adjusted Gamma UCL (use when n<50)	271.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.792	Mean of logged Data	3.572
Maximum of Logged Data	5.737	SD of logged Data	1.347

Assuming Lognormal Distribution

95% H-UCL	796	90% Chebyshev (MVUE) UCL	181.6
95% Chebyshev (MVUE) UCL	230.3	97.5% Chebyshev (MVUE) UCL	297.9
99% Chebyshev (MVUE) UCL	430.6		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	136.7	95% Jackknife UCL	145.8
95% Standard Bootstrap UCL	132.9	95% Bootstrap-t UCL	242.8
95% Hall's Bootstrap UCL	324.2	95% Percentile Bootstrap UCL	136.9
95% BCA Bootstrap UCL	159.8		
90% Chebyshev(Mean, Sd) UCL	186.2	95% Chebyshev(Mean, Sd) UCL	235.8
97.5% Chebyshev(Mean, Sd) UCL	304.6	99% Chebyshev(Mean, Sd) UCL	439.9

Suggested UCL to Use

95% Adjusted Gamma UCL	271.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	7	Number of Non-Detects	1
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.15	Minimum Non-Detect	0.067
Maximum Detect	2	Maximum Non-Detect	0.067
Variance Detects	0.453	Percent Non-Detects	12.5%
Mean Detects	0.676	SD Detects	0.673
Median Detects	0.28	CV Detects	0.995
Skewness Detects	1.507	Kurtosis Detects	2.016
Mean of Logged Detects	-0.799	SD of Logged Detects	0.968

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.293	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.6	KM Standard Error of Mean	0.236
KM SD	0.617	95% KM (BCA) UCL	1.008
95% KM (t) UCL	1.047	95% KM (Percentile Bootstrap) UCL	1.015
95% KM (z) UCL	0.988	95% KM Bootstrap t UCL	1.469
90% KM Chebyshev UCL	1.307	95% KM Chebyshev UCL	1.627
97.5% KM Chebyshev UCL	2.071	99% KM Chebyshev UCL	2.944

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.483	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.723	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.296	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.318	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.368	k star (bias corrected MLE)	0.877
Theta hat (MLE)	0.494	Theta star (bias corrected MLE)	0.771
nu hat (MLE)	19.16	nu star (bias corrected)	12.28
Mean (detects)	0.676		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.593
Maximum	2	Median	0.265
SD	0.666	CV	1.123
k hat (MLE)	0.79	k star (bias corrected MLE)	0.577
Theta hat (MLE)	0.751	Theta star (bias corrected MLE)	1.028
nu hat (MLE)	12.64	nu star (bias corrected)	9.235
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (9.23, α)	3.469	Adjusted Chi Square Value (9.23, β)	2.637
95% Gamma Approximate UCL (use when n>=50)	1.579	95% Gamma Adjusted UCL (use when n<50)	2.077

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.6	SD (KM)	0.617
Variance (KM)	0.38	SE of Mean (KM)	0.236
k hat (KM)	0.947	k star (KM)	0.675
nu hat (KM)	15.15	nu star (KM)	10.8
theta hat (KM)	0.634	theta star (KM)	0.889
80% gamma percentile (KM)	0.988	90% gamma percentile (KM)	1.519
95% gamma percentile (KM)	2.07	99% gamma percentile (KM)	3.387

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.80, α)	4.45	Adjusted Chi Square Value (10.80, β)	3.478
95% Gamma Approximate KM-UCL (use when n>=50)	1.457	95% Gamma Adjusted KM-UCL (use when n<50)	1.865

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.259	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.597	Mean in Log Scale	-1.098
SD in Original Scale	0.662	SD in Log Scale	1.231
95% t UCL (assumes normality of ROS data)	1.041	95% Percentile Bootstrap UCL	0.994
95% BCA Bootstrap UCL	1.098	95% Bootstrap t UCL	1.447
95% H-UCL (Log ROS)	4.622		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.037	KM Geo Mean	0.355
KM SD (logged)	1.048	95% Critical H Value (KM-Log)	3.546
KM Standard Error of Mean (logged)	0.4	95% H-UCL (KM -Log)	2.503
KM SD (logged)	1.048	95% Critical H Value (KM-Log)	3.546
KM Standard Error of Mean (logged)	0.4		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.596	Mean in Log Scale	-1.124
SD in Original Scale	0.663	SD in Log Scale	1.283
95% t UCL (Assumes normality)	1.04	95% H-Stat UCL	5.551

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.047

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	7.8	Mean	41.74
Maximum	130	Median	32.75
SD	40.16	Std. Error of Mean	14.2
Coefficient of Variation	0.962	Skewness	1.809

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	68.64	95% Adjusted-CLT UCL (Chen-1995)	74.8
		95% Modified-t UCL (Johnson-1978)	70.15

Gamma GOF Test

A-D Test Statistic	0.286	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.208	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.477	k star (bias corrected MLE)	1.006
Theta hat (MLE)	28.26	Theta star (bias corrected MLE)	41.48
nu hat (MLE)	23.63	nu star (bias corrected)	16.1
MLE Mean (bias corrected)	41.74	MLE Sd (bias corrected)	41.61
		Approximate Chi Square Value (0.05)	8.033
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	6.644

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	83.65	95% Adjusted Gamma UCL (use when n<50)	101.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.054	Mean of logged Data	3.356
Maximum of Logged Data	4.868	SD of logged Data	0.944

Assuming Lognormal Distribution

95% H-UCL	144.6	90% Chebyshev (MVUE) UCL	84.28
95% Chebyshev (MVUE) UCL	103.6	97.5% Chebyshev (MVUE) UCL	130.3
99% Chebyshev (MVUE) UCL	182.9		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	65.09	95% Jackknife UCL	68.64
95% Standard Bootstrap UCL	63.55	95% Bootstrap-t UCL	106.1
95% Hall's Bootstrap UCL	196	95% Percentile Bootstrap UCL	66.21
95% BCA Bootstrap UCL	74.14		
90% Chebyshev(Mean, Sd) UCL	84.34	95% Chebyshev(Mean, Sd) UCL	103.6
97.5% Chebyshev(Mean, Sd) UCL	130.4	99% Chebyshev(Mean, Sd) UCL	183

Suggested UCL to Use

95% Adjusted Gamma UCL	101.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	36	Mean	997.5
Maximum	3400	Median	103.5
SD	1442	Std. Error of Mean	509.9
Coefficient of Variation	1.446	Skewness	1.213

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.703	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.354	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1964	95% Adjusted-CLT UCL (Chen-1995)	2070
		95% Modified-t UCL (Johnson-1978)	2000

Gamma GOF Test

A-D Test Statistic	0.827	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.772	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.323	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.311	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.444	k star (bias corrected MLE)	0.361
Theta hat (MLE)	2245	Theta star (bias corrected MLE)	2762
nu hat (MLE)	7.11	nu star (bias corrected)	5.777
MLE Mean (bias corrected)	997.5	MLE Sd (bias corrected)	1660
		Approximate Chi Square Value (0.05)	1.527
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	1.042

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3774	95% Adjusted Gamma UCL (use when n<50)	5528

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.82	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.257	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.584	Mean of logged Data	5.449
Maximum of Logged Data	8.132	SD of logged Data	1.964

Assuming Lognormal Distribution

95% H-UCL	140898	90% Chebyshev (MVUE) UCL	3008
95% Chebyshev (MVUE) UCL	3918	97.5% Chebyshev (MVUE) UCL	5180
99% Chebyshev (MVUE) UCL	7661		

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1836	95% Jackknife UCL	1964
95% Standard Bootstrap UCL	1790	95% Bootstrap-t UCL	3975
95% Hall's Bootstrap UCL	2488	95% Percentile Bootstrap UCL	1794
95% BCA Bootstrap UCL	1997		
90% Chebyshev(Mean, Sd) UCL	2527	95% Chebyshev(Mean, Sd) UCL	3220
97.5% Chebyshev(Mean, Sd) UCL	4182	99% Chebyshev(Mean, Sd) UCL	6071

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	6071

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	6	Number of Non-Detects	2
Number of Distinct Detects	6	Number of Distinct Non-Detects	2
Minimum Detect	62	Minimum Non-Detect	20
Maximum Detect	140000	Maximum Non-Detect	25.5
Variance Detects	3.175E+9	Percent Non-Detects	25%
Mean Detects	25321	SD Detects	56346
Median Detects	400	CV Detects	2.225
Skewness Detects	2.418	Kurtosis Detects	5.874
Mean of Logged Detects	6.764	SD of Logged Detects	3.189

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.546	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.434	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	18996	KM Standard Error of Mean	17767
KM SD	45873	95% KM (BCA) UCL	52613
95% KM (t) UCL	52656	95% KM (Percentile Bootstrap) UCL	52539
95% KM (z) UCL	48219	95% KM Bootstrap t UCL	3930275
90% KM Chebyshev UCL	72296	95% KM Chebyshev UCL	96439
97.5% KM Chebyshev UCL	129948	99% KM Chebyshev UCL	195771

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.683	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.796	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.304	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.363	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.215	k star (bias corrected MLE)	0.219
Theta hat (MLE)	117517	Theta star (bias corrected MLE)	115703
nu hat (MLE)	2.586	nu star (bias corrected)	2.626
Mean (detects)	25321		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	18991
Maximum	140000	Median	81.5
SD	49043	CV	2.582
k hat (MLE)	0.132	k star (bias corrected MLE)	0.166
Theta hat (MLE)	143883	Theta star (bias corrected MLE)	114522
nu hat (MLE)	2.112	nu star (bias corrected)	2.653
Adjusted Level of Significance (β)	0.0195		
Approximate Chi Square Value (2.65, α)	0.278	Adjusted Chi Square Value (2.65, β)	0.161
95% Gamma Approximate UCL (use when n>=50)	181535	95% Gamma Adjusted UCL (use when n<50)	313921

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	18996	SD (KM)	45873
Variance (KM)	2.104E+9	SE of Mean (KM)	17767
k hat (KM)	0.171	k star (KM)	0.191
nu hat (KM)	2.744	nu star (KM)	3.048
theta hat (KM)	110781	theta star (KM)	99713
80% gamma percentile (KM)	24375	90% gamma percentile (KM)	57409
95% gamma percentile (KM)	99102	99% gamma percentile (KM)	214821

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.05, α)	0.387	Adjusted Chi Square Value (3.05, β)	0.223
95% Gamma Approximate KM-UCL (use when n>=50)	149692	95% Gamma Adjusted KM-UCL (use when n<50)	260066

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	18991	Mean in Log Scale	4.784
SD in Original Scale	49043	SD in Log Scale	4.55
95% t UCL (assumes normality of ROS data)	51841	95% Percentile Bootstrap UCL	52603
95% BCA Bootstrap UCL	70036	95% Bootstrap t UCL	3941442
95% H-UCL (Log ROS)	4.751E+16		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.822	KM Geo Mean	337.5
KM SD (logged)	3.003	95% Critical H Value (KM-Log)	9.015
KM Standard Error of Mean (logged)	1.163	95% H-UCL (KM -Log)	8.516E+8
KM SD (logged)	3.003	95% Critical H Value (KM-Log)	9.015
KM Standard Error of Mean (logged)	1.163		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	18993	Mean in Log Scale	5.679
SD in Original Scale	49042	SD in Log Scale	3.362
95% t UCL (Assumes normality)	51843	95% H-Stat UCL	2.962E+10

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	3930275	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	260066

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.2

Summary of ProUCL Output for EU13 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.14/24/2019 2:31:54 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Heptachlor epoxide

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Number of Detects	1	Number of Non-Detects	7
Number of Distinct Detects	1	Number of Distinct Non-Detects	7

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Heptachlor epoxide was not processed!

Table B.11.3

Summary of ProUCL Input Data for EU13 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Ethylbenzene	D_Ethylbenzene	Trichloroethene	D_Trichloroethene	Xylenes (total)	D_Xylenes (total)	Benzo(a)anthracene	D_Benzo(a)anthracene
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS	6.5	0	6.5	0	3.3	1	13	0		
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	10.5	0	21	0	1195	1	120	1	175	1
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	25	1	42	0	107.5	1	80	0	75	1
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	13	0	21	0	4000	1	32	0	5200	1
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	21	0	33	0	13000	1	54	0	5.1	0
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	1.2	0	0.99	0	1.5	0	1.5	0	61	1
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS			4000	1			14000	1	650	1
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	25	0	46	0	270	1	64	0	30	1
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	0.81	0	1.2	0	5.3	1	1.8	0	1500	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS										
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS										
on-site (EU13)	BH66-13	6/26/2013	10-12 ft BGS	11000	0	56000	1	11000	0	140000	1		
on-site (EU13)	BH67-13	6/20/2013	7-9 ft BGS	3600	0	59000	1	1800	1	73000	1		
on-site (EU13)	BH107-18	1/16/2018	12-14 ft BGS	0.34	0	0.28	0	2.8	1	0.42	0	3.5	0
on-site (EU13)	BH108-18	1/12/2018	7-9 ft BGS	40	0	46	0	2800	1	36	0	250	1
on-site (EU13)	BH109-18	1/16/2018	7.5-9.5 ft BGS	53	0	60	0	340	1	49	1	360	1
on-site (EU13)	BH110-18	1/16/2018	6.3-8.3 ft BGS	38	0	43	0	45	0	45	1	7.6	0
on-site (EU13)	BH159-17	12/18/2017	13-15 ft BGS										
on-site (EU13)	TT-40	11/3/2017	2-4 ft BGS										
on-site (EU13)	TT-40	11/3/2017	6-8 ft BGS	180	0	200	0	210	0	160	1	82	1

Table B.11.3

Summary of ProUCL Input Data for EU13 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				10	11	12	13	14	15	16	17	18	19
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS										
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	220	1	450	1	21	1	73	1	205	1
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	63	1	87	1	31.5	0	15	1	42	1
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	5200	1	8000	1	1100	1	920	1	3100	1
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	15	1	10	1	29	0	10	0	11	0
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	46	1	67	1	38	0	0.93	0	17	1
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	850	0	660	1	1700	0	630	0	670	0
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	28	1	47	1	25	0	9.2	0	9.8	0
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	1100	1	2900	1	170	1	310	1	820	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS										
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS										
on-site (EU13)	BH66-13	6/26/2013	10-12 ft BGS										
on-site (EU13)	BH67-13	6/20/2013	7-9 ft BGS										
on-site (EU13)	BH107-18	1/16/2018	12-14 ft BGS	88	1	120	1	150	0	3.7	0	50	1
on-site (EU13)	BH108-18	1/12/2018	7-9 ft BGS	390	1	640	1	34	1	51	1	210	1
on-site (EU13)	BH109-18	1/16/2018	7.5-9.5 ft BGS	310	1	480	1	220	0	5.4	0	180	1
on-site (EU13)	BH110-18	1/16/2018	6.3-8.3 ft BGS	7.7	0	7.1	0	320	0	7.9	0	4.2	0
on-site (EU13)	BH159-17	12/18/2017	13-15 ft BGS										
on-site (EU13)	TT-40	11/3/2017	2-4 ft BGS										
on-site (EU13)	TT-40	11/3/2017	6-8 ft BGS	110	1	110	1	310	0	7.7	0	4.1	0

Table B.11.3

Summary of ProUCL Input Data for EU13 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				20	21	22	23	24	25	26	27	28	29	30	31
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Naphthalene	D_Naphthalene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS												
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	70.5	1	7000	1	707	1	70.5	1	95	1	1.8	1
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	96	1	5300	1	1.15	1	18.5	1	240	1	0.21	1
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	390	1	8400	1	18	1	23	1	1800	1	13	1
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	3.6	0	7100	1	0.68	1	19	1	770	1	0.16	0
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	230	1	1700	1	0.33	0	7.9	1	57	1	0.44	1
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	4200	1	4500	1	0.59	1	3.6	1	55	1	0.36	1
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	140	1	7700	1	2.1	1	70	1	460	1	1.4	1
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	290	1	7800	1	23	1	52	1	1100	1	30	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS												
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS												
on-site (EU13)	BH66-13	6/26/2013	10-12 ft BGS												
on-site (EU13)	BH67-13	6/20/2013	7-9 ft BGS												
on-site (EU13)	BH107-18	1/16/2018	12-14 ft BGS	4.6	0	6800	1	0.24	1	5.7	1	1200	1	0.26	1
on-site (EU13)	BH108-18	1/12/2018	7-9 ft BGS	63	1	4900	1	4.3	1	11	1	660	1	4.9	1
on-site (EU13)	BH109-18	1/16/2018	7.5-9.5 ft BGS	3200	1	7700	1	2.8	1	51	1	290	1	1.8	1
on-site (EU13)	BH110-18	1/16/2018	6.3-8.3 ft BGS	290	1	14000	1	0.33	1	8.8	1	84	1	0.18	1
on-site (EU13)	BH159-17	12/18/2017	13-15 ft BGS												
on-site (EU13)	TT-40	11/3/2017	2-4 ft BGS												
on-site (EU13)	TT-40	11/3/2017	6-8 ft BGS	11000	1	1900	1	1.2	1	12	1	67	1	1.9	1

Table B.11.3

Summary of ProUCL Input Data for EU13 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				32	33	34	35	36	37	38	39	40	41	42	43
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS												
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	0.84	1	5.85	1	945	1	0.225	0	25000	1	13355	1
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	0.4	0	13	1	60.5	1	0.41	1	12250	1	41.5	1
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	0.29	0	17	1	1600	1	0.77	1	76000	1	1900	1
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	1.4	1	8.1	1	44	1	1.7	1	4800	1	38	1
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	0.5	1	2.9	1	12	1	1.9	1	7200	1	2.9	1
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	1.3	0	2.2	1	54	1	0.22	0	6400	1	190	1
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	1.6	0	13	1	310	1	4.1	1	13000	1	220	1
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	0.26	0	24	1	3300	1	0.38	1	180000	1	3400	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS												
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS												
on-site (EU13)	BH66-13	6/26/2013	10-12 ft BGS												
on-site (EU13)	BH67-13	6/20/2013	7-9 ft BGS												
on-site (EU13)	BH107-18	1/16/2018	12-14 ft BGS	0.27	0	4.4	1	22	1	0.055	0	11000	1	100	1
on-site (EU13)	BH108-18	1/12/2018	7-9 ft BGS	1.4	0	6.9	1	670	1	0.47	0	34000	1	730	1
on-site (EU13)	BH109-18	1/16/2018	7.5-9.5 ft BGS	1.5	0	8.3	1	950	1	2.9	1	45000	1	380	1
on-site (EU13)	BH110-18	1/16/2018	6.3-8.3 ft BGS	1.4	0	7.6	1	16	1	0.058	0	21000	1	14	1
on-site (EU13)	BH159-17	12/18/2017	13-15 ft BGS	1.4	0										
on-site (EU13)	TT-40	11/3/2017	2-4 ft BGS												
on-site (EU13)	TT-40	11/3/2017	6-8 ft BGS	2.6	1	3.5	1	370	1	0.53	1	18000	1	100	1

Table B.11.3

Summary of ProUCL Input Data for EU13 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				44	45	46	47	48	49
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Lead - coarse fraction	D_Lead - coarse fraction	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS						
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS						
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS						
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS						
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS						
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS						
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	6300	1	5300	1	35	1
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS						
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	980	1	1500	1	1100	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS						
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS						
on-site (EU13)	BH66-13	6/26/2013	10-12 ft BGS						
on-site (EU13)	BH67-13	6/20/2013	7-9 ft BGS						
on-site (EU13)	BH107-18	1/16/2018	12-14 ft BGS						
on-site (EU13)	BH108-18	1/12/2018	7-9 ft BGS						
on-site (EU13)	BH109-18	1/16/2018	7.5-9.5 ft BGS						
on-site (EU13)	BH110-18	1/16/2018	6.3-8.3 ft BGS						
on-site (EU13)	BH159-17	12/18/2017	13-15 ft BGS						
on-site (EU13)	TT-40	11/3/2017	2-4 ft BGS						
on-site (EU13)	TT-40	11/3/2017	6-8 ft BGS						

Table B.11.3

Summary of ProUCL Input Data for EU13 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				50	51	52	53	54	55	56	57	58	59	60	61
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS												
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	470	1	0.0095	1	117	1	0.15	1	19.5	1	1150	1
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	79.5	1	0.12	1	24	1	0.845	1	34.5	1	40	1
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	580	1	0.57	1	100	1	0.25	1	31	1	3100	1
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	20	1	0.18	1	17	1	0.28	1	36	1	87	1
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	150	1	0.039	1	10	1	0.21	1	7.8	1	47	1
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	560	1	0.19	1	6	1	0.067	0	9.1	1	36	1
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	60	1	0.087	1	29	1	2	1	66	1	120	1
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	2300	1	3.2	1	310	1	1	1	130	1	3400	1
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS												
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS												
on-site (EU13)	BH66-13	6/26/2013	10-12 ft BGS												
on-site (EU13)	BH67-13	6/20/2013	7-9 ft BGS												
on-site (EU13)	BH107-18	1/16/2018	12-14 ft BGS	280	1	0.039	1	12	1	0.13	1	16	1	360	1
on-site (EU13)	BH108-18	1/12/2018	7-9 ft BGS	470	1	0.49	1	41	1	0.11	1	16	1	860	1
on-site (EU13)	BH109-18	1/16/2018	7.5-9.5 ft BGS	320	1	0.48	1	29	1	1.2	1	30	1	370	1
on-site (EU13)	BH110-18	1/16/2018	6.3-8.3 ft BGS	620	1	0.037	1	17	1	0.17	1	33	1	53	1
on-site (EU13)	BH159-17	12/18/2017	13-15 ft BGS												
on-site (EU13)	TT-40	11/3/2017	2-4 ft BGS												
on-site (EU13)	TT-40	11/3/2017	6-8 ft BGS	600	1	0.031	1	17	1	0.22	1	5	1	310	1

Table B.11.3

Summary of ProUCL Input Data for EU13 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				62	63	64	65	66	67
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Heptachlor epoxide	D_Heptachlor epoxide
on-site (EU13)	BH74-13	6/20/2013	0-2 ft BGS	-					
on-site (EU13)	SS-54	10/30/2018	0.25-2.25 ft BGS	21	0	25.5	0	8.8	0
on-site (EU13)	SS-55	10/29/2018	0-2 ft BGS	31	0	62	1	17.5	0
on-site (EU13)	SS-56	10/30/2018	0-2 ft BGS	23	0	63	1	17	0
on-site (EU13)	SS-57	10/30/2018	0.25-2.25 ft BGS	28	0	700	1	21	0
on-site (EU13)	SS-58	11/3/2017	0-2 ft BGS	29	0	20	0	35	0
on-site (EU13)	SS-59	10/30/2018	0-2 ft BGS	1900	0	140000	1	150	0
on-site (EU13)	SS-60	10/30/2018	0.17-2.17 ft BGS	250	0	11000	1	75	1
on-site (EU13)	SS-61	10/30/2018	0-2 ft BGS	20	0	100	1	15	0
on-site (EU13)	SS-94	10/30/2018	0-2 ft BGS						
on-site (EU13)	SS-168-AS	10/30/2018	0-0.5 ft BGS						
on-site (EU13)	BH66-13	6/26/2013	10-12 ft BGS	380	1	300	1		
on-site (EU13)	BH67-13	6/20/2013	7-9 ft BGS	2000	0	16000	1		
on-site (EU13)	BH107-18	1/16/2018	12-14 ft BGS	22	0	27	0	130	0
on-site (EU13)	BH108-18	1/12/2018	7-9 ft BGS	22	0	180	1	14	0
on-site (EU13)	BH109-18	1/16/2018	7.5-9.5 ft BGS	120	0	1100	1	30	0
on-site (EU13)	BH110-18	1/16/2018	6.3-8.3 ft BGS	23	0	28	0	29	0
on-site (EU13)	BH159-17	12/18/2017	13-15 ft BGS						
on-site (EU13)	TT-40	11/3/2017	2-4 ft BGS						
on-site (EU13)	TT-40	11/3/2017	6-8 ft BGS	23	0	380	1	29	0

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	5
Number of Detects	1	Number of Non-Detects	14
Number of Distinct Detects	1	Number of Distinct Non-Detects	14

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,1-Dichloroethane was not processed!

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene

General Statistics

Total Number of Observations	16	Number of Distinct Observations	14
		Number of Missing Observations	4
Number of Detects	3	Number of Non-Detects	13
Number of Distinct Detects	3	Number of Distinct Non-Detects	11
Minimum Detect	4000	Minimum Non-Detect	0.28
Maximum Detect	59000	Maximum Non-Detect	200
Variance Detects	9.563E+8	Percent Non-Detects	81.25%
Mean Detects	39667	SD Detects	30925
Median Detects	56000	CV Detects	0.78
Skewness Detects	-1.714	Kurtosis Detects	N/A
Mean of Logged Detects	10.07	SD of Logged Detects	1.539

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.791	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.368	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7438	KM Standard Error of Mean	5803
KM SD	18954	95% KM (BCA) UCL	N/A
95% KM (t) UCL	17611	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	16983	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	24848	95% KM Chebyshev UCL	32734
97.5% KM Chebyshev UCL	43680	99% KM Chebyshev UCL	65180

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.103	k star (bias corrected MLE)	N/A
Theta hat (MLE)	35960	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	6.619	nu star (bias corrected)	N/A
Mean (detects)	39667		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	7438
Maximum	59000	Median	0.01
SD	19575	CV	2.632
k hat (MLE)	0.0777	k star (bias corrected MLE)	0.105
Theta hat (MLE)	95692	Theta star (bias corrected MLE)	70957
nu hat (MLE)	2.487	nu star (bias corrected)	3.354
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (3.35, α)	0.485	Adjusted Chi Square Value (3.35, β)	0.383
95% Gamma Approximate UCL (use when n>=50)	51475	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7438	SD (KM)	18954
Variance (KM)	3.592E+8	SE of Mean (KM)	5803
k hat (KM)	0.154	k star (KM)	0.167
nu hat (KM)	4.928	nu star (KM)	5.337
theta hat (KM)	48300	theta star (KM)	44595
80% gamma percentile (KM)	8775	90% gamma percentile (KM)	22317
95% gamma percentile (KM)	40043	99% gamma percentile (KM)	90422

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.34, α)	1.311	Adjusted Chi Square Value (5.34, β)	1.1
95% Gamma Approximate KM-UCL (use when n>=50)	30278	95% Gamma Adjusted KM-UCL (use when n<50)	36088

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.765	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.379	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	7472	Mean in Log Scale	4.664
SD in Original Scale	19561	SD in Log Scale	2.846
95% t UCL (assumes normality of ROS data)	16045	95% Percentile Bootstrap UCL	14897
95% BCA Bootstrap UCL	18535	95% Bootstrap t UCL	149397
95% H-UCL (Log ROS)	545932		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.854	KM Geo Mean	2.349
KM SD (logged)	4.461	95% Critical H Value (KM-Log)	9.363
KM Standard Error of Mean (logged)	1.366	95% H-UCL (KM -Log)	2.374E+9
KM SD (logged)	4.461	95% Critical H Value (KM-Log)	9.363
KM Standard Error of Mean (logged)	1.366		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7454	Mean in Log Scale	3.507
SD in Original Scale	19569	SD in Log Scale	3.726
95% t UCL (Assumes normality)	16030	95% H-Stat UCL	67606194

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	17611

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	5
Number of Detects	11	Number of Non-Detects	4
Number of Distinct Detects	11	Number of Distinct Non-Detects	4
Minimum Detect	2.8	Minimum Non-Detect	1.5
Maximum Detect	13000	Maximum Non-Detect	11000
Variance Detects	14740141	Percent Non-Detects	26.67%
Mean Detects	2139	SD Detects	3839
Median Detects	340	CV Detects	1.795
Skewness Detects	2.672	Kurtosis Detects	7.674
Mean of Logged Detects	5.48	SD of Logged Detects	3.001

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.618	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.289	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1624	KM Standard Error of Mean	890
KM SD	3270	95% KM (BCA) UCL	3279
95% KM (t) UCL	3192	95% KM (Percentile Bootstrap) UCL	3177
95% KM (z) UCL	3088	95% KM Bootstrap t UCL	6029
90% KM Chebyshev UCL	4294	95% KM Chebyshev UCL	5504
97.5% KM Chebyshev UCL	7182	99% KM Chebyshev UCL	10480

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.256	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.818	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.154	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.275	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.313	k star (bias corrected MLE)	0.288
Theta hat (MLE)	6832	Theta star (bias corrected MLE)	7419
nu hat (MLE)	6.886	nu star (bias corrected)	6.342
Mean (detects)	2139		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1568
Maximum	13000	Median	107.5
SD	3389	CV	2.161
k hat (MLE)	0.166	k star (bias corrected MLE)	0.177
Theta hat (MLE)	9458	Theta star (bias corrected MLE)	8855
nu hat (MLE)	4.975	nu star (bias corrected)	5.313
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (5.31, α)	1.299	Adjusted Chi Square Value (5.31, β)	1.074
95% Gamma Approximate UCL (use when n>=50)	6412	95% Gamma Adjusted UCL (use when n<50)	7760

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1624	SD (KM)	3270
Variance (KM)	10690374	SE of Mean (KM)	890
k hat (KM)	0.247	k star (KM)	0.242
nu hat (KM)	7.402	nu star (KM)	7.255
theta hat (KM)	6583	theta star (KM)	6716
80% gamma percentile (KM)	2330	90% gamma percentile (KM)	4885
95% gamma percentile (KM)	7939	99% gamma percentile (KM)	16105

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.25, α)	2.311	Adjusted Chi Square Value (7.25, β)	1.983
95% Gamma Approximate KM-UCL (use when n>=50)	5097	95% Gamma Adjusted KM-UCL (use when n<50)	5941

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1573	Mean in Log Scale	4.429
SD in Original Scale	3387	SD in Log Scale	3.282
95% t UCL (assumes normality of ROS data)	3113	95% Percentile Bootstrap UCL	3258
95% BCA Bootstrap UCL	3768	95% Bootstrap t UCL	6446
95% H-UCL (Log ROS)	9569906		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.506	KM Geo Mean	90.54
KM SD (logged)	3.142	95% Critical H Value (KM-Log)	6.855
KM Standard Error of Mean (logged)	0.886	95% H-UCL (KM -Log)	3982398
KM SD (logged)	3.142	95% Critical H Value (KM-Log)	6.855
KM Standard Error of Mean (logged)	0.886		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1943	Mean in Log Scale	5.092
SD in Original Scale	3498	SD in Log Scale	3.13
95% t UCL (Assumes normality)	3534	95% H-Stat UCL	6598404

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	5941

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total)

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	4
Number of Detects	7	Number of Non-Detects	9
Number of Distinct Detects	7	Number of Distinct Non-Detects	9
Minimum Detect	45	Minimum Non-Detect	0.42
Maximum Detect	140000	Maximum Non-Detect	80
Variance Detects	2.957E+9	Percent Non-Detects	56.25%
Mean Detects	32482	SD Detects	54374
Median Detects	160	CV Detects	1.674
Skewness Detects	1.694	Kurtosis Detects	2.119
Mean of Logged Detects	7.165	SD of Logged Detects	3.557

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.698	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.347	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	14213	KM Standard Error of Mean	9989
KM SD	36991	95% KM (BCA) UCL	32478
95% KM (t) UCL	31724	95% KM (Percentile Bootstrap) UCL	31706
95% KM (z) UCL	30643	95% KM Bootstrap t UCL	154865
90% KM Chebyshev UCL	44179	95% KM Chebyshev UCL	57753
97.5% KM Chebyshev UCL	76592	99% KM Chebyshev UCL	113598

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.665	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.813	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.333	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.341	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.224	k star (bias corrected MLE)	0.223
Theta hat (MLE)	144859	Theta star (bias corrected MLE)	145418
nu hat (MLE)	3.139	nu star (bias corrected)	3.127
Mean (detects)	32482		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	14211
Maximum	140000	Median	0.01
SD	38205	CV	2.688
k hat (MLE)	0.0911	k star (bias corrected MLE)	0.116
Theta hat (MLE)	155988	Theta star (bias corrected MLE)	122838
nu hat (MLE)	2.915	nu star (bias corrected)	3.702
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (3.70, α)	0.608	Adjusted Chi Square Value (3.70, β)	0.486
95% Gamma Approximate UCL (use when n>=50)	86580	95% Gamma Adjusted UCL (use when n<50)	108317

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	14213	SD (KM)	36991
Variance (KM)	1.368E+9	SE of Mean (KM)	9989
k hat (KM)	0.148	k star (KM)	0.162
nu hat (KM)	4.725	nu star (KM)	5.172
theta hat (KM)	96269	theta star (KM)	87940
80% gamma percentile (KM)	16395	90% gamma percentile (KM)	42523
95% gamma percentile (KM)	77045	99% gamma percentile (KM)	175748

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.17, α)	1.232	Adjusted Chi Square Value (5.17, β)	1.03
95% Gamma Approximate KM-UCL (use when n>=50)	59645	95% Gamma Adjusted KM-UCL (use when n<50)	71368

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.821	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.293	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14211	Mean in Log Scale	1.977
SD in Original Scale	38205	SD in Log Scale	5.267
95% t UCL (assumes normality of ROS data)	30955	95% Percentile Bootstrap UCL	31223
95% BCA Bootstrap UCL	39961	95% Bootstrap t UCL	159772
95% H-UCL (Log ROS)	2.420E+13		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.868	KM Geo Mean	17.6
KM SD (logged)	4.479	95% Critical H Value (KM-Log)	9.399
KM Standard Error of Mean (logged)	1.241	95% H-UCL (KM -Log)	2.103E+10
KM SD (logged)	4.479	95% Critical H Value (KM-Log)	9.399
KM Standard Error of Mean (logged)	1.241		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	14220	Mean in Log Scale	4.137
SD in Original Scale	38201	SD in Log Scale	3.83
95% t UCL (Assumes normality)	30962	95% H-Stat UCL	2.846E+8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	71368

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Number of Detects	10	Number of Non-Detects	3
Number of Distinct Detects	10	Number of Distinct Non-Detects	3
Minimum Detect	30	Minimum Non-Detect	3.5
Maximum Detect	5200	Maximum Non-Detect	7.6
Variance Detects	2547192	Percent Non-Detects	23.08%
Mean Detects	838.3	SD Detects	1596
Median Detects	212.5	CV Detects	1.904
Skewness Detects	2.76	Kurtosis Detects	7.903
Mean of Logged Detects	5.516	SD of Logged Detects	1.591

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.566	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.347	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	645.7	KM Standard Error of Mean	401.6
KM SD	1374	95% KM (BCA) UCL	1356
95% KM (t) UCL	1361	95% KM (Percentile Bootstrap) UCL	1385
95% KM (z) UCL	1306	95% KM Bootstrap t UCL	4662
90% KM Chebyshev UCL	1850	95% KM Chebyshev UCL	2396
97.5% KM Chebyshev UCL	3154	99% KM Chebyshev UCL	4642

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.658	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.775	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.519	k star (bias corrected MLE)	0.43
Theta hat (MLE)	1614	Theta star (bias corrected MLE)	1949
nu hat (MLE)	10.39	nu star (bias corrected)	8.604
Mean (detects)	838.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	644.8
Maximum	5200	Median	82
SD	1430	CV	2.218
k hat (MLE)	0.22	k star (bias corrected MLE)	0.221
Theta hat (MLE)	2926	Theta star (bias corrected MLE)	2921
nu hat (MLE)	5.729	nu star (bias corrected)	5.741
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (5.74, α)	1.509	Adjusted Chi Square Value (5.74, β)	1.223
95% Gamma Approximate UCL (use when n>=50)	2454	95% Gamma Adjusted UCL (use when n<50)	3027

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	645.7	SD (KM)	1374
Variance (KM)	1887149	SE of Mean (KM)	401.6
k hat (KM)	0.221	k star (KM)	0.221
nu hat (KM)	5.743	nu star (KM)	5.751
theta hat (KM)	2923	theta star (KM)	2919
80% gamma percentile (KM)	893.2	90% gamma percentile (KM)	1950
95% gamma percentile (KM)	3238	99% gamma percentile (KM)	6726

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.75, α)	1.514	Adjusted Chi Square Value (5.75, β)	1.228
95% Gamma Approximate KM-UCL (use when n>=50)	2452	95% Gamma Adjusted KM-UCL (use when n<50)	3025

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.157	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	646.1	Mean in Log Scale	4.628
SD in Original Scale	1430	SD in Log Scale	2.178
95% t UCL (assumes normality of ROS data)	1353	95% Percentile Bootstrap UCL	1363
95% BCA Bootstrap UCL	1775	95% Bootstrap t UCL	4733
95% H-UCL (Log ROS)	28758		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.532	KM Geo Mean	92.93
KM SD (logged)	2.231	95% Critical H Value (KM-Log)	5.311
KM Standard Error of Mean (logged)	0.652	95% H-UCL (KM -Log)	34222
KM SD (logged)	2.231	95% Critical H Value (KM-Log)	5.311
KM Standard Error of Mean (logged)	0.652		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	645.5	Mean in Log Scale	4.46
SD in Original Scale	1430	SD in Log Scale	2.438
95% t UCL (Assumes normality)	1352	95% H-Stat UCL	95931

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	4662	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	3025

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Number of Detects	11	Number of Non-Detects	2
Number of Distinct Detects	11	Number of Distinct Non-Detects	2
Minimum Detect	15	Minimum Non-Detect	7.7
Maximum Detect	5200	Maximum Non-Detect	850
Variance Detects	2336400	Percent Non-Detects	15.38%
Mean Detects	688.2	SD Detects	1529
Median Detects	110	CV Detects	2.221
Skewness Detects	3.088	Kurtosis Detects	9.786
Mean of Logged Detects	5.077	SD of Logged Detects	1.695

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.489	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.396	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	592.7	KM Standard Error of Mean	395.7
KM SD	1360	95% KM (BCA) UCL	1370
95% KM (t) UCL	1298	95% KM (Percentile Bootstrap) UCL	1338
95% KM (z) UCL	1244	95% KM Bootstrap t UCL	5730
90% KM Chebyshev UCL	1780	95% KM Chebyshev UCL	2318
97.5% KM Chebyshev UCL	3064	99% KM Chebyshev UCL	4530

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.838	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.792	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.25	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.271	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.444	k star (bias corrected MLE)	0.384
Theta hat (MLE)	1550	Theta star (bias corrected MLE)	1794
nu hat (MLE)	9.77	nu star (bias corrected)	8.439
Mean (detects)	688.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	582.3
Maximum	5200	Median	88
SD	1419	CV	2.437
k hat (MLE)	0.255	k star (bias corrected MLE)	0.247
Theta hat (MLE)	2286	Theta star (bias corrected MLE)	2355
nu hat (MLE)	6.624	nu star (bias corrected)	6.428
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (6.43, α)	1.863	Adjusted Chi Square Value (6.43, β)	1.534
95% Gamma Approximate UCL (use when n>=50)	2010	95% Gamma Adjusted UCL (use when n<50)	2440

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	592.7	SD (KM)	1360
Variance (KM)	1849131	SE of Mean (KM)	395.7
k hat (KM)	0.19	k star (KM)	0.197
nu hat (KM)	4.94	nu star (KM)	5.133
theta hat (KM)	3120	theta star (KM)	3002
80% gamma percentile (KM)	775.7	90% gamma percentile (KM)	1793
95% gamma percentile (KM)	3064	99% gamma percentile (KM)	6573

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.13, α)	1.214	Adjusted Chi Square Value (5.13, β)	0.967
95% Gamma Approximate KM-UCL (use when n>=50)	2506	95% Gamma Adjusted KM-UCL (use when n<50)	3145

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.133	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	588.2	Mean in Log Scale	4.715
SD in Original Scale	1417	SD in Log Scale	1.895
95% t UCL (assumes normality of ROS data)	1288	95% Percentile Bootstrap UCL	1342
95% BCA Bootstrap UCL	1745	95% Bootstrap t UCL	6194
95% H-UCL (Log ROS)	8069		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.778	KM Geo Mean	118.9
KM SD (logged)	1.732	95% Critical H Value (KM-Log)	4.197
KM Standard Error of Mean (logged)	0.514	95% H-UCL (KM -Log)	4347
KM SD (logged)	1.732	95% Critical H Value (KM-Log)	4.197
KM Standard Error of Mean (logged)	0.514		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	615.3	Mean in Log Scale	4.865
SD in Original Scale	1409	SD in Log Scale	1.893
95% t UCL (Assumes normality)	1312	95% H-Stat UCL	9309

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	5730	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	3145

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Number of Detects	12	Number of Non-Detects	1
Number of Distinct Detects	12	Number of Distinct Non-Detects	1
Minimum Detect	10	Minimum Non-Detect	7.1
Maximum Detect	8000	Maximum Non-Detect	7.1
Variance Detects	5307391	Percent Non-Detects	7.692%
Mean Detects	1131	SD Detects	2304
Median Detects	285	CV Detects	2.037
Skewness Detects	2.87	Kurtosis Detects	8.521
Mean of Logged Detects	5.542	SD of Logged Detects	1.854

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.536	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.414	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1044	KM Standard Error of Mean	620
KM SD	2140	95% KM (BCA) UCL	2144
95% KM (t) UCL	2149	95% KM (Percentile Bootstrap) UCL	2164
95% KM (z) UCL	2064	95% KM Bootstrap t UCL	8119
90% KM Chebyshev UCL	2904	95% KM Chebyshev UCL	3747
97.5% KM Chebyshev UCL	4916	99% KM Chebyshev UCL	7213

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.724	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.797	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.256	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.261	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.436	k star (bias corrected MLE)	0.383
Theta hat (MLE)	2594	Theta star (bias corrected MLE)	2956
nu hat (MLE)	10.46	nu star (bias corrected)	9.182
Mean (detects)	1131		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1044
Maximum	8000	Median	120
SD	2228	CV	2.134
k hat (MLE)	0.313	k star (bias corrected MLE)	0.292
Theta hat (MLE)	3337	Theta star (bias corrected MLE)	3576
nu hat (MLE)	8.134	nu star (bias corrected)	7.591
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (7.59, α)	2.5	Adjusted Chi Square Value (7.59, β)	2.104
95% Gamma Approximate UCL (use when n>=50)	3169	95% Gamma Adjusted UCL (use when n<50)	3766

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1044	SD (KM)	2140
Variance (KM)	4580547	SE of Mean (KM)	620
k hat (KM)	0.238	k star (KM)	0.234
nu hat (KM)	6.192	nu star (KM)	6.097
theta hat (KM)	4386	theta star (KM)	4454
80% gamma percentile (KM)	1481	90% gamma percentile (KM)	3147
95% gamma percentile (KM)	5152	99% gamma percentile (KM)	10536

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.10, α)	1.689	Adjusted Chi Square Value (6.10, β)	1.381
95% Gamma Approximate KM-UCL (use when n>=50)	3769	95% Gamma Adjusted KM-UCL (use when n<50)	4610

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1044	Mean in Log Scale	5.194
SD in Original Scale	2228	SD in Log Scale	2.176
95% t UCL (assumes normality of ROS data)	2145	95% Percentile Bootstrap UCL	2144
95% BCA Bootstrap UCL	2797	95% Bootstrap t UCL	8274
95% H-UCL (Log ROS)	50047		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.267	KM Geo Mean	193.8
KM SD (logged)	1.955	95% Critical H Value (KM-Log)	4.691
KM Standard Error of Mean (logged)	0.566	95% H-UCL (KM -Log)	18471
KM SD (logged)	1.955	95% Critical H Value (KM-Log)	4.691
KM Standard Error of Mean (logged)	0.566		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1044	Mean in Log Scale	5.213
SD in Original Scale	2228	SD in Log Scale	2.135
95% t UCL (Assumes normality)	2145	95% H-Stat UCL	41691

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	8119	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	4610

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Number of Detects	4	Number of Non-Detects	9
Number of Distinct Detects	4	Number of Distinct Non-Detects	9
Minimum Detect	21	Minimum Non-Detect	25
Maximum Detect	1100	Maximum Non-Detect	1700
Variance Detects	267197	Percent Non-Detects	69.23%
Mean Detects	331.3	SD Detects	516.9
Median Detects	102	CV Detects	1.56
Skewness Detects	1.902	Kurtosis Detects	3.635
Mean of Logged Detects	4.677	SD of Logged Detects	1.79

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.729	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.372	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	130.1	KM Standard Error of Mean	99.17
KM SD	296.1	95% KM (BCA) UCL	N/A
95% KM (t) UCL	306.8	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	293.2	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	427.6	95% KM Chebyshev UCL	562.4
97.5% KM Chebyshev UCL	749.4	99% KM Chebyshev UCL	1117

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.391	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.679	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.275	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.409	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.555	k star (bias corrected MLE)	0.306
Theta hat (MLE)	596.4	Theta star (bias corrected MLE)	1084
nu hat (MLE)	4.443	nu star (bias corrected)	2.444
Mean (detects)	331.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	101.9
Maximum	1100	Median	0.01
SD	303.5	CV	2.978
k hat (MLE)	0.124	k star (bias corrected MLE)	0.147
Theta hat (MLE)	822.7	Theta star (bias corrected MLE)	695.4
nu hat (MLE)	3.221	nu star (bias corrected)	3.811
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (3.81, α)	0.649	Adjusted Chi Square Value (3.81, β)	0.492
95% Gamma Approximate UCL (use when n>=50)	599	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	130.1	SD (KM)	296.1
Variance (KM)	87694	SE of Mean (KM)	99.17
k hat (KM)	0.193	k star (KM)	0.2
nu hat (KM)	5.016	nu star (KM)	5.192
theta hat (KM)	674.2	theta star (KM)	651.4
80% gamma percentile (KM)	171.3	90% gamma percentile (KM)	393.4
95% gamma percentile (KM)	670.5	99% gamma percentile (KM)	1434

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.19, α)	1.242	Adjusted Chi Square Value (5.19, β)	0.991
95% Gamma Approximate KM-UCL (use when n>=50)	543.8	95% Gamma Adjusted KM-UCL (use when n<50)	681.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	115.4	Mean in Log Scale	3.465
SD in Original Scale	298.7	SD in Log Scale	1.257
95% t UCL (assumes normality of ROS data)	263.1	95% Percentile Bootstrap UCL	279.1
95% BCA Bootstrap UCL	365.7	95% Bootstrap t UCL	4539
95% H-UCL (Log ROS)	234.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.691	KM Geo Mean	40.1
KM SD (logged)	1.194	95% Critical H Value (KM-Log)	3.195
KM Standard Error of Mean (logged)	0.422	95% H-UCL (KM -Log)	246.1
KM SD (logged)	1.194	95% Critical H Value (KM-Log)	3.195
KM Standard Error of Mean (logged)	0.422		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	210.5	Mean in Log Scale	4.269
SD in Original Scale	348.2	SD in Log Scale	1.513
95% t UCL (Assumes normality)	382.7	95% H-Stat UCL	1184

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	306.8

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Number of Detects	5	Number of Non-Detects	8
Number of Distinct Detects	5	Number of Distinct Non-Detects	8
Minimum Detect	15	Minimum Non-Detect	0.93
Maximum Detect	920	Maximum Non-Detect	630
Variance Detects	143956	Percent Non-Detects	61.54%
Mean Detects	273.8	SD Detects	379.4
Median Detects	73	CV Detects	1.386
Skewness Detects	1.78	Kurtosis Detects	3.035
Mean of Logged Detects	4.698	SD of Logged Detects	1.606

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.766	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.302	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	109	KM Standard Error of Mean	77.6
KM SD	249	95% KM (BCA) UCL	230.1
95% KM (t) UCL	247.3	95% KM (Percentile Bootstrap) UCL	229.5
95% KM (z) UCL	236.6	95% KM Bootstrap t UCL	814.4
90% KM Chebyshev UCL	341.8	95% KM Chebyshev UCL	447.3
97.5% KM Chebyshev UCL	593.6	99% KM Chebyshev UCL	881.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.302	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.703	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.273	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.368	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.666	k star (bias corrected MLE)	0.4
Theta hat (MLE)	411.2	Theta star (bias corrected MLE)	685.1
nu hat (MLE)	6.658	nu star (bias corrected)	3.996
Mean (detects)	273.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	105.3
Maximum	920	Median	0.01
SD	259.2	CV	2.462
k hat (MLE)	0.137	k star (bias corrected MLE)	0.157
Theta hat (MLE)	768.8	Theta star (bias corrected MLE)	672.2
nu hat (MLE)	3.562	nu star (bias corrected)	4.073
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (4.07, α)	0.751	Adjusted Chi Square Value (4.07, β)	0.575
95% Gamma Approximate UCL (use when n>=50)	571.3	95% Gamma Adjusted UCL (use when n<50)	745.5

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	109	SD (KM)	249
Variance (KM)	61977	SE of Mean (KM)	77.6
k hat (KM)	0.192	k star (KM)	0.199
nu hat (KM)	4.984	nu star (KM)	5.167
theta hat (KM)	568.6	theta star (KM)	548.5
80% gamma percentile (KM)	143.1	90% gamma percentile (KM)	329.6
95% gamma percentile (KM)	562.5	99% gamma percentile (KM)	1204

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.17, α)	1.23	Adjusted Chi Square Value (5.17, β)	0.981
95% Gamma Approximate KM-UCL (use when n>=50)	457.8	95% Gamma Adjusted KM-UCL (use when n<50)	574.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	106.6	Mean in Log Scale	2.185
SD in Original Scale	258.7	SD in Log Scale	2.293
95% t UCL (assumes normality of ROS data)	234.5	95% Percentile Bootstrap UCL	242.7
95% BCA Bootstrap UCL	338.5	95% Bootstrap t UCL	1177
95% H-UCL (Log ROS)	4525		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.881	KM Geo Mean	6.56
KM SD (logged)	2.503	95% Critical H Value (KM-Log)	5.873
KM Standard Error of Mean (logged)	0.8	95% H-UCL (KM -Log)	10492
KM SD (logged)	2.503	95% Critical H Value (KM-Log)	5.873
KM Standard Error of Mean (logged)	0.8		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	131.3	Mean in Log Scale	2.765
SD in Original Scale	262.4	SD in Log Scale	2.327
95% t UCL (Assumes normality)	261	95% H-Stat UCL	9648

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	247.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Number of Detects	8	Number of Non-Detects	5
Number of Distinct Detects	8	Number of Distinct Non-Detects	5
Minimum Detect	17	Minimum Non-Detect	4.1
Maximum Detect	3100	Maximum Non-Detect	670
Variance Detects	1104687	Percent Non-Detects	38.46%
Mean Detects	578	SD Detects	1051
Median Detects	192.5	CV Detects	1.818
Skewness Detects	2.529	Kurtosis Detects	6.558
Mean of Logged Detects	5.137	SD of Logged Detects	1.679

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.593	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.387	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	362.5	KM Standard Error of Mean	242.8
KM SD	818.5	95% KM (BCA) UCL	813.3
95% KM (t) UCL	795.2	95% KM (Percentile Bootstrap) UCL	801.2
95% KM (z) UCL	761.9	95% KM Bootstrap t UCL	3185
90% KM Chebyshev UCL	1091	95% KM Chebyshev UCL	1421
97.5% KM Chebyshev UCL	1879	99% KM Chebyshev UCL	2778

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.554	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.761	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.304	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.309	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.517	k star (bias corrected MLE)	0.406
Theta hat (MLE)	1118	Theta star (bias corrected MLE)	1422
nu hat (MLE)	8.269	nu star (bias corrected)	6.501
Mean (detects)	578		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	355.7
Maximum	3100	Median	42
SD	854.4	CV	2.402
k hat (MLE)	0.168	k star (bias corrected MLE)	0.181
Theta hat (MLE)	2111	Theta star (bias corrected MLE)	1966
nu hat (MLE)	4.381	nu star (bias corrected)	4.703
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (4.70, α)	1.018	Adjusted Chi Square Value (4.70, β)	0.799
95% Gamma Approximate UCL (use when n>=50)	1644	95% Gamma Adjusted UCL (use when n<50)	2093

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	362.5	SD (KM)	818.5
Variance (KM)	669971	SE of Mean (KM)	242.8
k hat (KM)	0.196	k star (KM)	0.202
nu hat (KM)	5.099	nu star (KM)	5.256
theta hat (KM)	1848	theta star (KM)	1793
80% gamma percentile (KM)	480.3	90% gamma percentile (KM)	1096
95% gamma percentile (KM)	1863	99% gamma percentile (KM)	3968

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.26, α)	1.272	Adjusted Chi Square Value (5.26, β)	1.017
95% Gamma Approximate KM-UCL (use when n>=50)	1498	95% Gamma Adjusted KM-UCL (use when n<50)	1873

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	358.8	Mean in Log Scale	3.805
SD in Original Scale	853.1	SD in Log Scale	2.23
95% t UCL (assumes normality of ROS data)	780.5	95% Percentile Bootstrap UCL	775.3
95% BCA Bootstrap UCL	1064	95% Bootstrap t UCL	3483
95% H-UCL (Log ROS)	16462		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.841	KM Geo Mean	46.59
KM SD (logged)	2.146	95% Critical H Value (KM-Log)	5.128
KM Standard Error of Mean (logged)	0.652	95% H-UCL (KM -Log)	11186
KM SD (logged)	2.146	95% Critical H Value (KM-Log)	5.128
KM Standard Error of Mean (logged)	0.652		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	382.6	Mean in Log Scale	3.974
SD in Original Scale	847.3	SD in Log Scale	2.342
95% t UCL (Assumes normality)	801.4	95% H-Stat UCL	35097

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	3185	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	1873

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Number of Detects	11	Number of Non-Detects	2
Number of Distinct Detects	10	Number of Distinct Non-Detects	2
Minimum Detect	63	Minimum Non-Detect	3.6
Maximum Detect	11000	Maximum Non-Detect	4.6
Variance Detects	11303814	Percent Non-Detects	15.38%
Mean Detects	1815	SD Detects	3362
Median Detects	290	CV Detects	1.852
Skewness Detects	2.433	Kurtosis Detects	6.176
Mean of Logged Detects	6.033	SD of Logged Detects	1.758

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.6	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.391	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1537	KM Standard Error of Mean	878.6
KM SD	3020	95% KM (BCA) UCL	3166
95% KM (t) UCL	3103	95% KM (Percentile Bootstrap) UCL	3001
95% KM (z) UCL	2982	95% KM Bootstrap t UCL	5765
90% KM Chebyshev UCL	4172	95% KM Chebyshev UCL	5366
97.5% KM Chebyshev UCL	7023	99% KM Chebyshev UCL	10278

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.072	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.793	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.339	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.271	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.441	k star (bias corrected MLE)	0.381
Theta hat (MLE)	4120	Theta star (bias corrected MLE)	4764
nu hat (MLE)	9.693	nu star (bias corrected)	8.383
Mean (detects)	1815		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1536
Maximum	11000	Median	230
SD	3144	CV	2.047
k hat (MLE)	0.243	k star (bias corrected MLE)	0.238
Theta hat (MLE)	6329	Theta star (bias corrected MLE)	6454
nu hat (MLE)	6.311	nu star (bias corrected)	6.188
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (6.19, α)	1.737	Adjusted Chi Square Value (6.19, β)	1.423
95% Gamma Approximate UCL (use when n>=50)	5473	95% Gamma Adjusted UCL (use when n<50)	6680

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1537	SD (KM)	3020
Variance (KM)	9122569	SE of Mean (KM)	878.6
k hat (KM)	0.259	k star (KM)	0.25
nu hat (KM)	6.73	nu star (KM)	6.51
theta hat (KM)	5937	theta star (KM)	6137
80% gamma percentile (KM)	2233	90% gamma percentile (KM)	4612
95% gamma percentile (KM)	7435	99% gamma percentile (KM)	14947

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.51, α)	1.906	Adjusted Chi Square Value (6.51, β)	1.573
95% Gamma Approximate KM-UCL (use when n>=50)	5249	95% Gamma Adjusted KM-UCL (use when n<50)	6361

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.243	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1537	Mean in Log Scale	5.406
SD in Original Scale	3143	SD in Log Scale	2.218
95% t UCL (assumes normality of ROS data)	3091	95% Percentile Bootstrap UCL	3138
95% BCA Bootstrap UCL	3649	95% Bootstrap t UCL	5780
95% H-UCL (Log ROS)	76731		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.302	KM Geo Mean	200.8
KM SD (logged)	2.306	95% Critical H Value (KM-Log)	5.469
KM Standard Error of Mean (logged)	0.671	95% H-UCL (KM -Log)	109232
KM SD (logged)	2.306	95% Critical H Value (KM-Log)	5.469
KM Standard Error of Mean (logged)	0.671		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1536	Mean in Log Scale	5.215
SD in Original Scale	3144	SD in Log Scale	2.564
95% t UCL (Assumes normality)	3090	95% H-Stat UCL	418435

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	7023	99% KM (Chebyshev) UCL	10278

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Minimum	1700	Mean	6523
Maximum	14000	Median	7000
SD	3127	Std. Error of Mean	867.2
Coefficient of Variation	0.479	Skewness	0.66

Normal GOF Test

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8069	95% Adjusted-CLT UCL (Chen-1995)	8119
		95% Modified-t UCL (Johnson-1978)	8095

Gamma GOF Test

A-D Test Statistic	0.702	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.215	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.238	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.94	k star (bias corrected MLE)	3.082
Theta hat (MLE)	1656	Theta star (bias corrected MLE)	2117
nu hat (MLE)	102.4	nu star (bias corrected)	80.13
MLE Mean (bias corrected)	6523	MLE Sd (bias corrected)	3716
		Approximate Chi Square Value (0.05)	60.5
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	58.08

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8639	95% Adjusted Gamma UCL (use when n<50)	9000

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.438	Mean of logged Data	8.651
Maximum of Logged Data	9.547	SD of logged Data	0.585

Assuming Lognormal Distribution

95% H-UCL	9866	90% Chebyshev (MVUE) UCL	10050
95% Chebyshev (MVUE) UCL	11576	97.5% Chebyshev (MVUE) UCL	13693
99% Chebyshev (MVUE) UCL	17852		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7950	95% Jackknife UCL	8069
95% Standard Bootstrap UCL	7890	95% Bootstrap-t UCL	8279
95% Hall's Bootstrap UCL	8685	95% Percentile Bootstrap UCL	7908
95% BCA Bootstrap UCL	8077		
90% Chebyshev(Mean, Sd) UCL	9125	95% Chebyshev(Mean, Sd) UCL	10303
97.5% Chebyshev(Mean, Sd) UCL	11939	99% Chebyshev(Mean, Sd) UCL	15152

Suggested UCL to Use

95% Student's-t UCL	8069

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Number of Detects	12	Number of Non-Detects	1
Number of Distinct Detects	12	Number of Distinct Non-Detects	1
Minimum Detect	0.24	Minimum Non-Detect	0.33
Maximum Detect	707	Maximum Non-Detect	0.33
Variance Detects	41130	Percent Non-Detects	7.692%
Mean Detects	63.45	SD Detects	202.8
Median Detects	1.65	CV Detects	3.196
Skewness Detects	3.456	Kurtosis Detects	11.96
Mean of Logged Detects	1.058	SD of Logged Detects	2.242

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.352	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.496	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	58.59	KM Standard Error of Mean	54.26
KM SD	187.3	95% KM (BCA) UCL	167.1
95% KM (t) UCL	155.3	95% KM (Percentile Bootstrap) UCL	165.9
95% KM (z) UCL	147.8	95% KM Bootstrap t UCL	2335
90% KM Chebyshev UCL	221.4	95% KM Chebyshev UCL	295.1
97.5% KM Chebyshev UCL	397.4	99% KM Chebyshev UCL	598.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.888	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.856	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.333	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.27	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.232	k star (bias corrected MLE)	0.23
Theta hat (MLE)	273	Theta star (bias corrected MLE)	276.1
nu hat (MLE)	5.577	nu star (bias corrected)	5.516
Mean (detects)	63.45		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	58.57
Maximum	707	Median	1.2
SD	195	CV	3.329
k hat (MLE)	0.212	k star (bias corrected MLE)	0.214
Theta hat (MLE)	276.9	Theta star (bias corrected MLE)	273.7
nu hat (MLE)	5.5	nu star (bias corrected)	5.564
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (5.56, α)	1.421	Adjusted Chi Square Value (5.56, β)	1.147
95% Gamma Approximate UCL (use when n>=50)	229.3	95% Gamma Adjusted UCL (use when n<50)	284.2

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	58.59	SD (KM)	187.3
Variance (KM)	35086	SE of Mean (KM)	54.26
k hat (KM)	0.0978	k star (KM)	0.127
nu hat (KM)	2.544	nu star (KM)	3.29
theta hat (KM)	598.9	theta star (KM)	463
80% gamma percentile (KM)	54.44	90% gamma percentile (KM)	168.3
95% gamma percentile (KM)	331.9	99% gamma percentile (KM)	825

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.29, α)	0.463	Adjusted Chi Square Value (3.29, β)	0.343
95% Gamma Approximate KM-UCL (use when n>=50)	416.1	95% Gamma Adjusted KM-UCL (use when n<50)	561.3

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.179	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	58.57	Mean in Log Scale	0.76
SD in Original Scale	195	SD in Log Scale	2.4
95% t UCL (assumes normality of ROS data)	154.9	95% Percentile Bootstrap UCL	166.3
95% BCA Bootstrap UCL	221.2	95% Bootstrap t UCL	2355
95% H-UCL (Log ROS)	1926		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.866	KM Geo Mean	2.378
KM SD (logged)	2.166	95% Critical H Value (KM-Log)	5.171
KM Standard Error of Mean (logged)	0.627	95% H-UCL (KM -Log)	630.1
KM SD (logged)	2.166	95% Critical H Value (KM-Log)	5.171
KM Standard Error of Mean (logged)	0.627		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	58.58	Mean in Log Scale	0.838
SD in Original Scale	195	SD in Log Scale	2.288
95% t UCL (Assumes normality)	155	95% H-Stat UCL	1147

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	598.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Minimum	3.6	Mean	27.15
Maximum	70.5	Median	18.5
SD	24.62	Std. Error of Mean	6.828
Coefficient of Variation	0.907	Skewness	0.949

Normal GOF Test

Shapiro Wilk Test Statistic	0.81	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.259	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	39.32	95% Adjusted-CLT UCL (Chen-1995)	40.3
		95% Modified-t UCL (Johnson-1978)	39.62

Gamma GOF Test

A-D Test Statistic	0.516	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.17	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.242	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.348	k star (bias corrected MLE)	1.089
Theta hat (MLE)	20.14	Theta star (bias corrected MLE)	24.94
nu hat (MLE)	35.06	nu star (bias corrected)	28.3
MLE Mean (bias corrected)	27.15	MLE Sd (bias corrected)	26.03
		Approximate Chi Square Value (0.05)	17.16
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	15.94

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	44.78	95% Adjusted Gamma UCL (use when n<50)	48.22

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.941	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.165	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.281	Mean of logged Data	2.887
Maximum of Logged Data	4.256	SD of logged Data	0.979

Assuming Lognormal Distribution

95% H-UCL	64.07	90% Chebyshev (MVUE) UCL	51.68
95% Chebyshev (MVUE) UCL	62.61	97.5% Chebyshev (MVUE) UCL	77.79
99% Chebyshev (MVUE) UCL	107.6		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	38.38	95% Jackknife UCL	39.32
95% Standard Bootstrap UCL	38.33	95% Bootstrap-t UCL	43.22
95% Hall's Bootstrap UCL	37.59	95% Percentile Bootstrap UCL	38.04
95% BCA Bootstrap UCL	39.86		
90% Chebyshev(Mean, Sd) UCL	47.64	95% Chebyshev(Mean, Sd) UCL	56.92
97.5% Chebyshev(Mean, Sd) UCL	69.79	99% Chebyshev(Mean, Sd) UCL	95.09

Suggested UCL to Use

95% Adjusted Gamma UCL	48.22

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Minimum	55	Mean	529.1
Maximum	1800	Median	290
SD	552.2	Std. Error of Mean	153.2
Coefficient of Variation	1.044	Skewness	1.192

Normal GOF Test

Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	802.1	95% Adjusted-CLT UCL (Chen-1995)	835.1
		95% Modified-t UCL (Johnson-1978)	810.5

Gamma GOF Test

A-D Test Statistic	0.459	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.762	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.244	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.916	k star (bias corrected MLE)	0.756
Theta hat (MLE)	577.4	Theta star (bias corrected MLE)	699.7
nu hat (MLE)	23.82	nu star (bias corrected)	19.66
MLE Mean (bias corrected)	529.1	MLE Sd (bias corrected)	608.4
		Approximate Chi Square Value (0.05)	10.6
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	9.664

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	981.2	95% Adjusted Gamma UCL (use when n<50)	1076

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.007	Mean of logged Data	5.635
Maximum of Logged Data	7.496	SD of logged Data	1.269

Assuming Lognormal Distribution

95% H-UCL	2126	90% Chebyshev (MVUE) UCL	1229
95% Chebyshev (MVUE) UCL	1528	97.5% Chebyshev (MVUE) UCL	1943
99% Chebyshev (MVUE) UCL	2759		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	781	95% Jackknife UCL	802.1
95% Standard Bootstrap UCL	778.4	95% Bootstrap-t UCL	867.4
95% Hall's Bootstrap UCL	854.5	95% Percentile Bootstrap UCL	776.6
95% BCA Bootstrap UCL	841.8		
90% Chebyshev(Mean, Sd) UCL	988.6	95% Chebyshev(Mean, Sd) UCL	1197
97.5% Chebyshev(Mean, Sd) UCL	1486	99% Chebyshev(Mean, Sd) UCL	2053

Suggested UCL to Use

95% Student's-t UCL	802.1

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Number of Detects	12	Number of Non-Detects	1
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	0.18	Minimum Non-Detect	0.16
Maximum Detect	30	Maximum Non-Detect	0.16
Variance Detects	76.53	Percent Non-Detects	7.692%
Mean Detects	4.688	SD Detects	8.748
Median Detects	1.6	CV Detects	1.866
Skewness Detects	2.65	Kurtosis Detects	7.198
Mean of Logged Detects	0.27	SD of Logged Detects	1.649

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.578	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.375	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.339	KM Standard Error of Mean	2.357
KM SD	8.137	95% KM (BCA) UCL	8.822
95% KM (t) UCL	8.54	95% KM (Percentile Bootstrap) UCL	8.418
95% KM (z) UCL	8.216	95% KM Bootstrap t UCL	24.94
90% KM Chebyshev UCL	11.41	95% KM Chebyshev UCL	14.61
97.5% KM Chebyshev UCL	19.06	99% KM Chebyshev UCL	27.79

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.795	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.785	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.259	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.499	k star (bias corrected MLE)	0.429
Theta hat (MLE)	9.402	Theta star (bias corrected MLE)	10.91
nu hat (MLE)	11.97	nu star (bias corrected)	10.31
Mean (detects)	4.688		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4.328
Maximum	30	Median	1.4
SD	8.476	CV	1.958
k hat (MLE)	0.416	k star (bias corrected MLE)	0.372
Theta hat (MLE)	10.39	Theta star (bias corrected MLE)	11.64
nu hat (MLE)	10.83	nu star (bias corrected)	9.663
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (9.66, α)	3.732	Adjusted Chi Square Value (9.66, β)	3.225
95% Gamma Approximate UCL (use when n>=50)	11.2	95% Gamma Adjusted UCL (use when n<50)	12.97

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.339	SD (KM)	8.137
Variance (KM)	66.21	SE of Mean (KM)	2.357
k hat (KM)	0.284	k star (KM)	0.27
nu hat (KM)	7.394	nu star (KM)	7.021
theta hat (KM)	15.26	theta star (KM)	16.07
80% gamma percentile (KM)	6.464	90% gamma percentile (KM)	12.94
95% gamma percentile (KM)	20.52	99% gamma percentile (KM)	40.48

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.02, α)	2.182	Adjusted Chi Square Value (7.02, β)	1.818
95% Gamma Approximate KM-UCL (use when n>=50)	13.96	95% Gamma Adjusted KM-UCL (use when n<50)	16.75

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.163	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.329	Mean in Log Scale	-0.0392
SD in Original Scale	8.475	SD in Log Scale	1.934
95% t UCL (assumes normality of ROS data)	8.518	95% Percentile Bootstrap UCL	8.271
95% BCA Bootstrap UCL	10.72	95% Bootstrap t UCL	24.33
95% H-UCL (Log ROS)	83.09		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.109	KM Geo Mean	1.115
KM SD (logged)	1.617	95% Critical H Value (KM-Log)	3.997
KM Standard Error of Mean (logged)	0.468	95% H-UCL (KM -Log)	26.64
KM SD (logged)	1.617	95% Critical H Value (KM-Log)	3.997
KM Standard Error of Mean (logged)	0.468		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.333	Mean in Log Scale	0.0553
SD in Original Scale	8.473	SD in Log Scale	1.759
95% t UCL (Assumes normality)	8.521	95% H-Stat UCL	42.92

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	19.06	99% KM (Chebyshev) UCL	27.79

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	11
		Number of Missing Observations	6
Number of Detects	4	Number of Non-Detects	10
Number of Distinct Detects	4	Number of Distinct Non-Detects	8
Minimum Detect	0.5	Minimum Non-Detect	0.26
Maximum Detect	2.6	Maximum Non-Detect	1.6
Variance Detects	0.849	Percent Non-Detects	71.43%
Mean Detects	1.335	SD Detects	0.921
Median Detects	1.12	CV Detects	0.69
Skewness Detects	1.126	Kurtosis Detects	0.871
Mean of Logged Detects	0.106	SD of Logged Detects	0.705

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.639	KM Standard Error of Mean	0.211
KM SD	0.642	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.012	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.985	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.27	95% KM Chebyshev UCL	1.556
97.5% KM Chebyshev UCL	1.953	99% KM Chebyshev UCL	2.733

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.218	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.66	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.201	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.397	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.891	k star (bias corrected MLE)	0.889
Theta hat (MLE)	0.462	Theta star (bias corrected MLE)	1.501
nu hat (MLE)	23.13	nu star (bias corrected)	7.115
Mean (detects)	1.335		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.416
Maximum	2.6	Median	0.01
SD	0.755	CV	1.814
k hat (MLE)	0.322	k star (bias corrected MLE)	0.3
Theta hat (MLE)	1.294	Theta star (bias corrected MLE)	1.385
nu hat (MLE)	9.006	nu star (bias corrected)	8.41
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (8.41, α)	2.974	Adjusted Chi Square Value (8.41, β)	2.562
95% Gamma Approximate UCL (use when n>=50)	1.176	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.639	SD (KM)	0.642
Variance (KM)	0.413	SE of Mean (KM)	0.211
k hat (KM)	0.988	k star (KM)	0.824
nu hat (KM)	27.67	nu star (KM)	23.08
theta hat (KM)	0.646	theta star (KM)	0.775
80% gamma percentile (KM)	1.042	90% gamma percentile (KM)	1.542
95% gamma percentile (KM)	2.05	99% gamma percentile (KM)	3.247

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (23.08, α)	13.15	Adjusted Chi Square Value (23.08, β)	12.16
95% Gamma Approximate KM-UCL (use when n>=50)	1.121	95% Gamma Adjusted KM-UCL (use when n<50)	1.212

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.995	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.155	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.565	Mean in Log Scale	-0.991
SD in Original Scale	0.678	SD in Log Scale	0.859
95% t UCL (assumes normality of ROS data)	0.886	95% Percentile Bootstrap UCL	0.881
95% BCA Bootstrap UCL	0.996	95% Bootstrap t UCL	1.474
95% H-UCL (Log ROS)	0.991		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.783	KM Geo Mean	0.457
KM SD (logged)	0.744	95% Critical H Value (KM-Log)	2.398
KM Standard Error of Mean (logged)	0.267	95% H-UCL (KM -Log)	0.989
KM SD (logged)	0.744	95% Critical H Value (KM-Log)	2.398
KM Standard Error of Mean (logged)	0.267		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.732	Mean in Log Scale	-0.655
SD in Original Scale	0.642	SD in Log Scale	0.908
95% t UCL (Assumes normality)	1.036	95% H-Stat UCL	1.527

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.012

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Minimum	2.2	Mean	8.981
Maximum	24	Median	7.6
SD	6.281	Std. Error of Mean	1.742
Coefficient of Variation	0.699	Skewness	1.269

Normal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.235	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	12.09	95% Adjusted-CLT UCL (Chen-1995)	12.5
		95% Modified-t UCL (Johnson-1978)	12.19

Gamma GOF Test

A-D Test Statistic	0.206	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.154	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.239	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.416	k star (bias corrected MLE)	1.91
Theta hat (MLE)	3.717	Theta star (bias corrected MLE)	4.703
nu hat (MLE)	62.81	nu star (bias corrected)	49.65
MLE Mean (bias corrected)	8.981	MLE Sd (bias corrected)	6.499
		Approximate Chi Square Value (0.05)	34.47
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	32.68

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	12.93	95% Adjusted Gamma UCL (use when n<50)	13.65

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.112	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.788	Mean of logged Data	1.974
Maximum of Logged Data	3.178	SD of logged Data	0.705

Assuming Lognormal Distribution

95% H-UCL	14.98	90% Chebyshev (MVUE) UCL	14.56
95% Chebyshev (MVUE) UCL	17.07	97.5% Chebyshev (MVUE) UCL	20.56
99% Chebyshev (MVUE) UCL	27.4		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	11.85	95% Jackknife UCL	12.09
95% Standard Bootstrap UCL	11.78	95% Bootstrap-t UCL	13.33
95% Hall's Bootstrap UCL	13.93	95% Percentile Bootstrap UCL	11.83
95% BCA Bootstrap UCL	12.56		
90% Chebyshev(Mean, Sd) UCL	14.21	95% Chebyshev(Mean, Sd) UCL	16.57
97.5% Chebyshev(Mean, Sd) UCL	19.86	99% Chebyshev(Mean, Sd) UCL	26.31

Suggested UCL to Use

95% Student's-t UCL	12.09

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Minimum	12	Mean	642.6
Maximum	3300	Median	310
SD	938.5	Std. Error of Mean	260.3
Coefficient of Variation	1.461	Skewness	2.18

Normal GOF Test

Shapiro Wilk Test Statistic	0.716	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1106	95% Adjusted-CLT UCL (Chen-1995)	1239
		95% Modified-t UCL (Johnson-1978)	1133

Gamma GOF Test

A-D Test Statistic	0.435	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.79	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.221	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.501	k star (bias corrected MLE)	0.437
Theta hat (MLE)	1283	Theta star (bias corrected MLE)	1472
nu hat (MLE)	13.02	nu star (bias corrected)	11.35
MLE Mean (bias corrected)	642.6	MLE Sd (bias corrected)	972.5
		Approximate Chi Square Value (0.05)	4.802
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	4.211

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1519	95% Adjusted Gamma UCL (use when n<50)	1732

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.179	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.485	Mean of logged Data	5.198
Maximum of Logged Data	8.102	SD of logged Data	1.905

Assuming Lognormal Distribution

95% H-UCL	13671	90% Chebyshev (MVUE) UCL	2272
95% Chebyshev (MVUE) UCL	2929	97.5% Chebyshev (MVUE) UCL	3840
99% Chebyshev (MVUE) UCL	5629		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1071	95% Jackknife UCL	1106
95% Standard Bootstrap UCL	1056	95% Bootstrap-t UCL	1587
95% Hall's Bootstrap UCL	2913	95% Percentile Bootstrap UCL	1110
95% BCA Bootstrap UCL	1311		
90% Chebyshev(Mean, Sd) UCL	1423	95% Chebyshev(Mean, Sd) UCL	1777
97.5% Chebyshev(Mean, Sd) UCL	2268	99% Chebyshev(Mean, Sd) UCL	3232

Suggested UCL to Use

95% Adjusted Gamma UCL	1732

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Number of Detects	8	Number of Non-Detects	5
Number of Distinct Detects	8	Number of Distinct Non-Detects	5
Minimum Detect	0.38	Minimum Non-Detect	0.055
Maximum Detect	4.1	Maximum Non-Detect	0.47
Variance Detects	1.825	Percent Non-Detects	38.46%
Mean Detects	1.586	SD Detects	1.351
Median Detects	1.235	CV Detects	0.852
Skewness Detects	1.01	Kurtosis Detects	0.105
Mean of Logged Detects	0.112	SD of Logged Detects	0.92

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.006	KM Standard Error of Mean	0.366
KM SD	1.235	95% KM (BCA) UCL	1.641
95% KM (t) UCL	1.659	95% KM (Percentile Bootstrap) UCL	1.591
95% KM (z) UCL	1.609	95% KM Bootstrap t UCL	2.062
90% KM Chebyshev UCL	2.105	95% KM Chebyshev UCL	2.603
97.5% KM Chebyshev UCL	3.294	99% KM Chebyshev UCL	4.651

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.373	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.299	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.575	k star (bias corrected MLE)	1.068
Theta hat (MLE)	1.007	Theta star (bias corrected MLE)	1.485
nu hat (MLE)	25.21	nu star (bias corrected)	17.09
Mean (detects)	1.586		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.98
Maximum	4.1	Median	0.41
SD	1.305	CV	1.331
k hat (MLE)	0.392	k star (bias corrected MLE)	0.353
Theta hat (MLE)	2.498	Theta star (bias corrected MLE)	2.775
nu hat (MLE)	10.2	nu star (bias corrected)	9.181
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (9.18, α)	3.436	Adjusted Chi Square Value (9.18, β)	2.954
95% Gamma Approximate UCL (use when n>=50)	2.618	95% Gamma Adjusted UCL (use when n<50)	3.046

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.006	SD (KM)	1.235
Variance (KM)	1.524	SE of Mean (KM)	0.366
k hat (KM)	0.664	k star (KM)	0.562
nu hat (KM)	17.26	nu star (KM)	14.61
theta hat (KM)	1.515	theta star (KM)	1.79
80% gamma percentile (KM)	1.658	90% gamma percentile (KM)	2.655
95% gamma percentile (KM)	3.706	99% gamma percentile (KM)	6.264

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (14.61, α)	6.993	Adjusted Chi Square Value (14.61, β)	6.256
95% Gamma Approximate KM-UCL (use when n>=50)	2.102	95% Gamma Adjusted KM-UCL (use when n<50)	2.35

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.024	Mean in Log Scale	-0.737
SD in Original Scale	1.27	SD in Log Scale	1.326
95% t UCL (assumes normality of ROS data)	1.652	95% Percentile Bootstrap UCL	1.619
95% BCA Bootstrap UCL	1.736	95% Bootstrap t UCL	2.115
95% H-UCL (Log ROS)	4.302		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.996	KM Geo Mean	0.369
KM SD (logged)	1.585	95% Critical H Value (KM-Log)	3.94
KM Standard Error of Mean (logged)	0.477	95% H-UCL (KM -Log)	7.866
KM SD (logged)	1.585	95% Critical H Value (KM-Log)	3.94
KM Standard Error of Mean (logged)	0.477		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.016	Mean in Log Scale	-0.929
SD in Original Scale	1.277	SD in Log Scale	1.633
95% t UCL (Assumes normality)	1.647	95% H-Stat UCL	9.974

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.659

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Minimum	4800	Mean	34896
Maximum	180000	Median	18000
SD	47847	Std. Error of Mean	13270
Coefficient of Variation	1.371	Skewness	2.706

Normal GOF Test

Shapiro Wilk Test Statistic	0.633	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	58548	95% Adjusted-CLT UCL (Chen-1995)	67366
		95% Modified-t UCL (Johnson-1978)	60208

Gamma GOF Test

A-D Test Statistic	0.618	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.184	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.243	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.025	k star (bias corrected MLE)	0.839
Theta hat (MLE)	34059	Theta star (bias corrected MLE)	41571
nu hat (MLE)	26.64	nu star (bias corrected)	21.83
MLE Mean (bias corrected)	34896	MLE Sd (bias corrected)	38088
		Approximate Chi Square Value (0.05)	12.21
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	11.19

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	62390	95% Adjusted Gamma UCL (use when n<50)	68040

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.122	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.476	Mean of logged Data	9.898
Maximum of Logged Data	12.1	SD of logged Data	1.032

Assuming Lognormal Distribution

95% H-UCL	80440	90% Chebyshev (MVUE) UCL	61712
95% Chebyshev (MVUE) UCL	75167	97.5% Chebyshev (MVUE) UCL	93842
99% Chebyshev (MVUE) UCL	130526		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	56724	95% Jackknife UCL	58548
95% Standard Bootstrap UCL	56573	95% Bootstrap-t UCL	108622
95% Hall's Bootstrap UCL	145787	95% Percentile Bootstrap UCL	57142
95% BCA Bootstrap UCL	68369		
90% Chebyshev(Mean, Sd) UCL	74707	95% Chebyshev(Mean, Sd) UCL	92741
97.5% Chebyshev(Mean, Sd) UCL	117770	99% Chebyshev(Mean, Sd) UCL	166935

Suggested UCL to Use

95% Adjusted Gamma UCL	68040

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Minimum	2.9	Mean	1575
Maximum	13355	Median	190
SD	3675	Std. Error of Mean	1019
Coefficient of Variation	2.334	Skewness	3.199

Normal GOF Test

Shapiro Wilk Test Statistic	0.487	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.36	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3391	95% Adjusted-CLT UCL (Chen-1995)	4218
		95% Modified-t UCL (Johnson-1978)	3542

Gamma GOF Test

A-D Test Statistic	0.676	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.825	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.255	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.327	k star (bias corrected MLE)	0.302
Theta hat (MLE)	4822	Theta star (bias corrected MLE)	5206
nu hat (MLE)	8.491	nu star (bias corrected)	7.865
MLE Mean (bias corrected)	1575	MLE Sd (bias corrected)	2863
		Approximate Chi Square Value (0.05)	2.657
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	2.245

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	4661	95% Adjusted Gamma UCL (use when n<50)	5516

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.992	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0957	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.065	Mean of logged Data	5.279
Maximum of Logged Data	9.5	SD of logged Data	2.31

Assuming Lognormal Distribution

95% H-UCL	109055	90% Chebyshev (MVUE) UCL	5187
95% Chebyshev (MVUE) UCL	6775	97.5% Chebyshev (MVUE) UCL	8979
99% Chebyshev (MVUE) UCL	13308		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3251	95% Jackknife UCL	3391
95% Standard Bootstrap UCL	3222	95% Bootstrap-t UCL	10509
95% Hall's Bootstrap UCL	10031	95% Percentile Bootstrap UCL	3436
95% BCA Bootstrap UCL	4521		
90% Chebyshev(Mean, Sd) UCL	4633	95% Chebyshev(Mean, Sd) UCL	6018
97.5% Chebyshev(Mean, Sd) UCL	7940	99% Chebyshev(Mean, Sd) UCL	11716

Suggested UCL to Use

95% Adjusted Gamma UCL	5516

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	7
Minimum	980	Mean	3640
Maximum	6300	Median	3640

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - coarse fraction was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Lead - fine fraction

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	7
Minimum	1500	Mean	3400
Maximum	5300	Median	3400

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - fine fraction was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	7
Minimum	35	Mean	567.5
Maximum	1100	Median	567.5

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - total (calculated by fine/coarse fraction) was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Minimum	20	Mean	500.7
Maximum	2300	Median	470
SD	583.1	Std. Error of Mean	161.7
Coefficient of Variation	1.165	Skewness	2.73

Normal GOF Test

Shapiro Wilk Test Statistic	0.664	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.342	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	789	95% Adjusted-CLT UCL (Chen-1995)	897.6
		95% Modified-t UCL (Johnson-1978)	809.4

Gamma GOF Test

A-D Test Statistic	0.467	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.243	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.017	k star (bias corrected MLE)	0.833
Theta hat (MLE)	492.5	Theta star (bias corrected MLE)	600.8
nu hat (MLE)	26.44	nu star (bias corrected)	21.67
MLE Mean (bias corrected)	500.7	MLE Sd (bias corrected)	548.5
		Approximate Chi Square Value (0.05)	12.09
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	11.08

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	897.4	95% Adjusted Gamma UCL (use when n<50)	979.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.196	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.996	Mean of logged Data	5.649
Maximum of Logged Data	7.741	SD of logged Data	1.242

Assuming Lognormal Distribution

95% H-UCL	1997	90% Chebyshev (MVUE) UCL	1198
95% Chebyshev (MVUE) UCL	1486	97.5% Chebyshev (MVUE) UCL	1887
99% Chebyshev (MVUE) UCL	2673		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	766.7	95% Jackknife UCL	789
95% Standard Bootstrap UCL	749	95% Bootstrap-t UCL	1063
95% Hall's Bootstrap UCL	1873	95% Percentile Bootstrap UCL	774.6
95% BCA Bootstrap UCL	875.4		
90% Chebyshev(Mean, Sd) UCL	985.9	95% Chebyshev(Mean, Sd) UCL	1206
97.5% Chebyshev(Mean, Sd) UCL	1511	99% Chebyshev(Mean, Sd) UCL	2110

Suggested UCL to Use

95% Adjusted Gamma UCL	979.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Minimum	0.0095	Mean	0.421
Maximum	3.2	Median	0.12
SD	0.858	Std. Error of Mean	0.238
Coefficient of Variation	2.037	Skewness	3.29

Normal GOF Test

Shapiro Wilk Test Statistic	0.497	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.354	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.845	95% Adjusted-CLT UCL (Chen-1995)	1.044
		95% Modified-t UCL (Johnson-1978)	0.881

Gamma GOF Test

A-D Test Statistic	0.748	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.788	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.249	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.53	k star (bias corrected MLE)	0.459
Theta hat (MLE)	0.795	Theta star (bias corrected MLE)	0.918
nu hat (MLE)	13.77	nu star (bias corrected)	11.93
MLE Mean (bias corrected)	0.421	MLE Sd (bias corrected)	0.622
		Approximate Chi Square Value (0.05)	5.179
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	4.561

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.969	95% Adjusted Gamma UCL (use when n<50)	1.101

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.16	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-4.656	Mean of logged Data	-2.054
Maximum of Logged Data	1.163	SD of logged Data	1.573

Assuming Lognormal Distribution

95% H-UCL	2.621	90% Chebyshev (MVUE) UCL	0.913
95% Chebyshev (MVUE) UCL	1.159	97.5% Chebyshev (MVUE) UCL	1.499
99% Chebyshev (MVUE) UCL	2.168		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.812	95% Jackknife UCL	0.845
95% Standard Bootstrap UCL	0.791	95% Bootstrap-t UCL	1.925
95% Hall's Bootstrap UCL	2.139	95% Percentile Bootstrap UCL	0.859
95% BCA Bootstrap UCL	1.112		
90% Chebyshev(Mean, Sd) UCL	1.135	95% Chebyshev(Mean, Sd) UCL	1.458
97.5% Chebyshev(Mean, Sd) UCL	1.907	99% Chebyshev(Mean, Sd) UCL	2.788

Suggested UCL to Use

95% Adjusted Gamma UCL	1.101

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	13	Number of Distinct Observations	10
		Number of Missing Observations	7
Minimum	6	Mean	56.08
Maximum	310	Median	24
SD	83.66	Std. Error of Mean	23.2
Coefficient of Variation	1.492	Skewness	2.711

Normal GOF Test

Shapiro Wilk Test Statistic	0.607	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.341	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	97.43	95% Adjusted-CLT UCL (Chen-1995)	112.9
		95% Modified-t UCL (Johnson-1978)	100.3

Gamma GOF Test

A-D Test Statistic	0.922	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.763	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.268	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.244	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.891	k star (bias corrected MLE)	0.737
Theta hat (MLE)	62.92	Theta star (bias corrected MLE)	76.11
nu hat (MLE)	23.17	nu star (bias corrected)	19.16
MLE Mean (bias corrected)	56.08	MLE Sd (bias corrected)	65.33
		Approximate Chi Square Value (0.05)	10.23
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	9.315

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	105	95% Adjusted Gamma UCL (use when n<50)	115.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.792	Mean of logged Data	3.37
Maximum of Logged Data	5.737	SD of logged Data	1.099

Assuming Lognormal Distribution

95% H-UCL	138.8	90% Chebyshev (MVUE) UCL	99.23
95% Chebyshev (MVUE) UCL	121.6	97.5% Chebyshev (MVUE) UCL	152.8
99% Chebyshev (MVUE) UCL	213.9		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	94.24	95% Jackknife UCL	97.43
95% Standard Bootstrap UCL	91.7	95% Bootstrap-t UCL	162.6
95% Hall's Bootstrap UCL	209.3	95% Percentile Bootstrap UCL	95.15
95% BCA Bootstrap UCL	116.2		
90% Chebyshev(Mean, Sd) UCL	125.7	95% Chebyshev(Mean, Sd) UCL	157.2
97.5% Chebyshev(Mean, Sd) UCL	201	99% Chebyshev(Mean, Sd) UCL	287

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	157.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Number of Detects	12	Number of Non-Detects	1
Number of Distinct Detects	12	Number of Distinct Non-Detects	1
Minimum Detect	0.11	Minimum Non-Detect	0.067
Maximum Detect	2	Maximum Non-Detect	0.067
Variance Detects	0.352	Percent Non-Detects	7.692%
Mean Detects	0.547	SD Detects	0.594
Median Detects	0.235	CV Detects	1.085
Skewness Detects	1.603	Kurtosis Detects	2.105
Mean of Logged Detects	-1.079	SD of Logged Detects	0.983

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.749	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.34	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.51	KM Standard Error of Mean	0.162
KM SD	0.561	95% KM (BCA) UCL	0.779
95% KM (t) UCL	0.8	95% KM (Percentile Bootstrap) UCL	0.788
95% KM (z) UCL	0.777	95% KM Bootstrap t UCL	1.023
90% KM Chebyshev UCL	0.998	95% KM Chebyshev UCL	1.218
97.5% KM Chebyshev UCL	1.525	99% KM Chebyshev UCL	2.127

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.92	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.752	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.298	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.251	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.191	k star (bias corrected MLE)	0.949
Theta hat (MLE)	0.46	Theta star (bias corrected MLE)	0.577
nu hat (MLE)	28.57	nu star (bias corrected)	22.76
Mean (detects)	0.547		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.506
Maximum	2	Median	0.22
SD	0.588	CV	1.162
k hat (MLE)	0.878	k star (bias corrected MLE)	0.726
Theta hat (MLE)	0.576	Theta star (bias corrected MLE)	0.696
nu hat (MLE)	22.82	nu star (bias corrected)	18.89
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (18.89, α)	10.03	Adjusted Chi Square Value (18.89, β)	9.127
95% Gamma Approximate UCL (use when n>=50)	0.952	95% Gamma Adjusted UCL (use when n<50)	1.047

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.51	SD (KM)	0.561
Variance (KM)	0.315	SE of Mean (KM)	0.162
k hat (KM)	0.827	k star (KM)	0.688
nu hat (KM)	21.51	nu star (KM)	17.88
theta hat (KM)	0.617	theta star (KM)	0.742
80% gamma percentile (KM)	0.839	90% gamma percentile (KM)	1.286
95% gamma percentile (KM)	1.748	99% gamma percentile (KM)	2.851

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.88, α)	9.306	Adjusted Chi Square Value (17.88, β)	8.437
95% Gamma Approximate KM-UCL (use when n>=50)	0.98	95% Gamma Adjusted KM-UCL (use when n<50)	1.081

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.507	Mean in Log Scale	-1.259
SD in Original Scale	0.586	SD in Log Scale	1.145
95% t UCL (assumes normality of ROS data)	0.797	95% Percentile Bootstrap UCL	0.79
95% BCA Bootstrap UCL	0.829	95% Bootstrap t UCL	1.016
95% H-UCL (Log ROS)	1.525		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.204	KM Geo Mean	0.3
KM SD (logged)	1.002	95% Critical H Value (KM-Log)	2.852
KM Standard Error of Mean (logged)	0.29	95% H-UCL (KM -Log)	1.132
KM SD (logged)	1.002	95% Critical H Value (KM-Log)	2.852
KM Standard Error of Mean (logged)	0.29		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.508	Mean in Log Scale	-1.257
SD in Original Scale	0.586	SD in Log Scale	1.14
95% t UCL (Assumes normality)	0.797	95% H-Stat UCL	1.508

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1.132

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Minimum	5	Mean	33.38
Maximum	130	Median	30
SD	33.26	Std. Error of Mean	9.223
Coefficient of Variation	0.996	Skewness	2.329

Normal GOF Test

Shapiro Wilk Test Statistic	0.731	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.315	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	49.82	95% Adjusted-CLT UCL (Chen-1995)	54.91
		95% Modified-t UCL (Johnson-1978)	50.81

Gamma GOF Test

A-D Test Statistic	0.384	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.203	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.241	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.528	k star (bias corrected MLE)	1.227
Theta hat (MLE)	21.85	Theta star (bias corrected MLE)	27.21
nu hat (MLE)	39.72	nu star (bias corrected)	31.89
MLE Mean (bias corrected)	33.38	MLE Sd (bias corrected)	30.14
		Approximate Chi Square Value (0.05)	19.99
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	18.65

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	53.26	95% Adjusted Gamma UCL (use when n<50)	57.07

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.157	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.609	Mean of logged Data	3.146
Maximum of Logged Data	4.868	SD of logged Data	0.886

Assuming Lognormal Distribution

95% H-UCL	67.86	90% Chebyshev (MVUE) UCL	59.11
95% Chebyshev (MVUE) UCL	70.89	97.5% Chebyshev (MVUE) UCL	87.24
99% Chebyshev (MVUE) UCL	119.4		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	48.55	95% Jackknife UCL	49.82
95% Standard Bootstrap UCL	47.81	95% Bootstrap-t UCL	70.83
95% Hall's Bootstrap UCL	125.1	95% Percentile Bootstrap UCL	50.03
95% BCA Bootstrap UCL	56.62		
90% Chebyshev(Mean, Sd) UCL	61.05	95% Chebyshev(Mean, Sd) UCL	73.58
97.5% Chebyshev(Mean, Sd) UCL	90.98	99% Chebyshev(Mean, Sd) UCL	125.1

Suggested UCL to Use

95% Adjusted Gamma UCL	57.07

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	7
Minimum	36	Mean	764.1
Maximum	3400	Median	310
SD	1156	Std. Error of Mean	320.6
Coefficient of Variation	1.513	Skewness	1.838

Normal GOF Test

Shapiro Wilk Test Statistic	0.666	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.326	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1335	95% Adjusted-CLT UCL (Chen-1995)	1466
		95% Modified-t UCL (Johnson-1978)	1363

Gamma GOF Test

A-D Test Statistic	0.672	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.785	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.2	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.249	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.562	k star (bias corrected MLE)	0.483
Theta hat (MLE)	1361	Theta star (bias corrected MLE)	1581
nu hat (MLE)	14.6	nu star (bias corrected)	12.56
MLE Mean (bias corrected)	764.1	MLE Sd (bias corrected)	1099
		Approximate Chi Square Value (0.05)	5.601
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	4.954

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1714	95% Adjusted Gamma UCL (use when n<50)	1938

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.14	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.584	Mean of logged Data	5.528
Maximum of Logged Data	8.132	SD of logged Data	1.615

Assuming Lognormal Distribution

95% H-UCL	5966	90% Chebyshev (MVUE) UCL	1920
95% Chebyshev (MVUE) UCL	2441	97.5% Chebyshev (MVUE) UCL	3165
99% Chebyshev (MVUE) UCL	4587		

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1291	95% Jackknife UCL	1335
95% Standard Bootstrap UCL	1260	95% Bootstrap-t UCL	2321
95% Hall's Bootstrap UCL	3695	95% Percentile Bootstrap UCL	1314
95% BCA Bootstrap UCL	1466		
90% Chebyshev(Mean, Sd) UCL	1726	95% Chebyshev(Mean, Sd) UCL	2162
97.5% Chebyshev(Mean, Sd) UCL	2766	99% Chebyshev(Mean, Sd) UCL	3954

Suggested UCL to Use

95% Adjusted Gamma UCL	1938

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	12
		Number of Missing Observations	5
Number of Detects	1	Number of Non-Detects	14
Number of Distinct Detects	1	Number of Distinct Non-Detects	11

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1242 (PCB-1242) was not processed!

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	5
Number of Detects	11	Number of Non-Detects	4
Number of Distinct Detects	11	Number of Distinct Non-Detects	4
Minimum Detect	62	Minimum Non-Detect	20
Maximum Detect	140000	Maximum Non-Detect	28
Variance Detects	1.736E+9	Percent Non-Detects	26.67%
Mean Detects	15444	SD Detects	41660
Median Detects	380	CV Detects	2.697
Skewness Detects	3.22	Kurtosis Detects	10.51
Mean of Logged Detects	6.737	SD of Logged Detects	2.523

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.429	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.404	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	11331	KM Standard Error of Mean	9395
KM SD	34692	95% KM (BCA) UCL	30274
95% KM (t) UCL	27878	95% KM (Percentile Bootstrap) UCL	29007
95% KM (z) UCL	26784	95% KM Bootstrap t UCL	144474
90% KM Chebyshev UCL	39515	95% KM Chebyshev UCL	52281
97.5% KM Chebyshev UCL	70001	99% KM Chebyshev UCL	104807

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.203	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.843	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.32	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.279	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.245	k star (bias corrected MLE)	0.239
Theta hat (MLE)	63034	Theta star (bias corrected MLE)	64675
nu hat (MLE)	5.39	nu star (bias corrected)	5.254
Mean (detects)	15444		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	11326
Maximum	140000	Median	180
SD	35912	CV	3.171
k hat (MLE)	0.138	k star (bias corrected MLE)	0.155
Theta hat (MLE)	81895	Theta star (bias corrected MLE)	73031
nu hat (MLE)	4.149	nu star (bias corrected)	4.652
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (4.65, α)	0.995	Adjusted Chi Square Value (4.65, β)	0.807
95% Gamma Approximate UCL (use when n>=50)	52950	95% Gamma Adjusted UCL (use when n<50)	65285

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	11331	SD (KM)	34692
Variance (KM)	1.204E+9	SE of Mean (KM)	9395
k hat (KM)	0.107	k star (KM)	0.13
nu hat (KM)	3.2	nu star (KM)	3.894
theta hat (KM)	106217	theta star (KM)	87305
80% gamma percentile (KM)	10807	90% gamma percentile (KM)	32736
95% gamma percentile (KM)	63955	99% gamma percentile (KM)	157456

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.89, α)	0.68	Adjusted Chi Square Value (3.89, β)	0.537
95% Gamma Approximate KM-UCL (use when n>=50)	64869	95% Gamma Adjusted KM-UCL (use when n<50)	82093

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	11326	Mean in Log Scale	5.132
SD in Original Scale	35911	SD in Log Scale	3.484
95% t UCL (assumes normality of ROS data)	27658	95% Percentile Bootstrap UCL	29225
95% BCA Bootstrap UCL	39170	95% Bootstrap t UCL	144612
95% H-UCL (Log ROS)	81478194		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.739	KM Geo Mean	310.7
KM SD (logged)	2.642	95% Critical H Value (KM-Log)	5.843
KM Standard Error of Mean (logged)	0.716	95% H-UCL (KM -Log)	631577
KM SD (logged)	2.642	95% Critical H Value (KM-Log)	5.843
KM Standard Error of Mean (logged)	0.716		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	11329	Mean in Log Scale	5.613
SD in Original Scale	35910	SD in Log Scale	2.876
95% t UCL (Assumes normality)	27660	95% H-Stat UCL	2205749

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	104807

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.11.4

Summary of ProUCL Output for EU013 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:38:10 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Heptachlor epoxide

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	7
Number of Detects	1	Number of Non-Detects	12
Number of Distinct Detects	1	Number of Distinct Non-Detects	11

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Heptachlor epoxide was not processed!

Table B.12.1

Summary of ProUCL Input Data for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS	270	0	180	1	270	0				
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	0.91	0	3.4	1	1.1	0	110	1	140	1
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	31	1	35	1	39	1	330	1	260	1
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	15	0	6400	1	16	0	1700	1	2000	1
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	110	1	50	1	410	1	59	1	39	1
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	2.6	1	5.2	1	1.6	1	200	1	260	1
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS			9.6	1			990	1	890	1
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS										
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	12	0	2200	1	13	0	850	1	940	1
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS										
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS										

Table B.12.1

Summary of ProUCL Input Data for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				10	11	12	13	14	15	16	17	18	19
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum	D_Aluminum
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS										
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	360	1	130	0	47	0	120	1	4300	1
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	370	1	60	1	20	0	150	1	5900	1
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	3000	1	71	1	510	1	1700	1	8200	1
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	61	1	29	0	11	0	18	1	6800	1
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	430	1	110	0	91	1	320	1	4000	1
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS	1300	1	120	1	200	1	640	1	9200	1
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS										
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	1200	1	76	1	230	1	720	1	7700	1
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS										
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS										

Table B.12.1

Summary of ProUCL Input Data for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				20	21	22	23	24	25	26	27	28	29	30	31
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS												
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	2.8	1	25	1	200	1	3.7	1	0.33	0	7.2	1
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	1.9	1	8.3	1	160	1	0.8	1	0.28	0	5.2	1
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	11	1	17	1	3100	1	11	1	0.95	1	16	1
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	1.2	1	16	1	260	1	0.63	1	0.64	1	12	1
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	10	1	9	1	240	1	5.9	1	1.3	0	5.1	1
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS	8.5	1	20	1	2800	1	9.3	1	1.2	1	17	1
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS												
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	13	1	33	1	1200	1	8.5	1	0.55	1	13	1
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS												
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS												

Table B.12.1

Summary of ProUCL Input Data for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				32	33	34	35	36	37	38	39	40	41	42	43
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Lead - coarse fraction	D_Lead - coarse fraction	Lead - fine fraction	D_Lead - fine fraction
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS												
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	460	1	0.78	1	50000	1	340	1				
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	250	1	0.23	0	16000	1	510	1				
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	2400	1	2.7	1	71000	1	4200	1	3600	1	3600	1
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	62	1	0.29	0	60000	1	22	1				
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	1300	1	0.21	0	21000	1	700	1	47000	1	28000	1
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS	1600	1	13	1	58000	1	1600	1				
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS												
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	1700	1	0.56	1	62000	1	3300	1				
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS												
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS												

Table B.12.1

Summary of ProUCL Input Data for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				44	45	46	47	48	49	50	51
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS								
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS			310	1	0.22	1	19	1
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS			300	1	0.24	1	18	1
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	3600	1	750	1	0.23	1	28	1
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS			230	1	0.49	1	46	1
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	43000	1	400	1	0.11	1	13	1
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS			880	1	0.3	1	34	1
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS								
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS			630	1	0.17	1	29	1
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS								
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS								

Table B.12.1

Summary of ProUCL Input Data for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				52	53	54	55	56	57	58	59
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Zinc	D_Zinc	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Aroclor-1260 (PCB-1260)	D_Aroclor-1260 (PCB-1260)
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS								
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	270	1	25	0	54	1	29	0
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	310	1	21	0	330	1	24	0
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	3000	1	24	0	390	1	28	0
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	58	1	29	0	35	0	250	1
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	470	1	420	0	510	0	14000	1
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS	2300	1	23	0	99	1	27	0
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS								
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	2000	1	370	1	620	1	26	0
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS								
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS								

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Number of Detects	3	Number of Non-Detects	4
Number of Distinct Detects	3	Number of Distinct Non-Detects	4
Minimum Detect	2.6	Minimum Non-Detect	0.91
Maximum Detect	110	Maximum Non-Detect	270
Variance Detects	3097	Percent Non-Detects	57.14%
Mean Detects	47.87	SD Detects	55.65
Median Detects	31	CV Detects	1.163
Skewness Detects	1.239	Kurtosis Detects	N/A
Mean of Logged Detects	3.03	SD of Logged Detects	1.905

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.286	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	24.67	KM Standard Error of Mean	19.82
KM SD	39.63	95% KM (BCA) UCL	N/A
95% KM (t) UCL	63.18	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	57.27	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	84.13	95% KM Chebyshev UCL	111.1
97.5% KM Chebyshev UCL	148.4	99% KM Chebyshev UCL	221.9

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.718	k star (bias corrected MLE)	N/A
Theta hat (MLE)	66.64	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	4.309	nu star (bias corrected)	N/A
Mean (detects)	47.87		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	20.52
Maximum	110	Median	0.01
SD	41.07	CV	2.001
k hat (MLE)	0.173	k star (bias corrected MLE)	0.194
Theta hat (MLE)	118.7	Theta star (bias corrected MLE)	105.8
nu hat (MLE)	2.42	nu star (bias corrected)	2.716
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (2.72, α)	0.294	Adjusted Chi Square Value (2.72, β)	0.152
95% Gamma Approximate UCL (use when n>=50)	189.9	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	24.67	SD (KM)	39.63
Variance (KM)	1571	SE of Mean (KM)	19.82
k hat (KM)	0.387	k star (KM)	0.317
nu hat (KM)	5.424	nu star (KM)	4.433
theta hat (KM)	63.67	theta star (KM)	77.91
80% gamma percentile (KM)	38.31	90% gamma percentile (KM)	72.27
95% gamma percentile (KM)	110.9	99% gamma percentile (KM)	210.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.43, α)	0.9	Adjusted Chi Square Value (4.43, β)	0.517
95% Gamma Approximate KM-UCL (use when n>=50)	121.5	95% Gamma Adjusted KM-UCL (use when n<50)	211.7

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	21.12	Mean in Log Scale	1.057
SD in Original Scale	40.73	SD in Log Scale	2.316
95% t UCL (assumes normality of ROS data)	51.03	95% Percentile Bootstrap UCL	48.03
95% BCA Bootstrap UCL	63.44	95% Bootstrap t UCL	739
95% H-UCL (Log ROS)	63980		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.643	KM Geo Mean	5.17
KM SD (logged)	1.805	95% Critical H Value (KM-Log)	6.131
KM Standard Error of Mean (logged)	0.927	95% H-UCL (KM -Log)	2410
KM SD (logged)	1.805	95% Critical H Value (KM-Log)	6.131
KM Standard Error of Mean (logged)	0.927		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	41.79	Mean in Log Scale	2.431
SD in Original Scale	56.51	SD in Log Scale	2.057
95% t UCL (Assumes normality)	83.3	95% H-Stat UCL	31765

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	63.18

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	8	Number of Distinct Observations	8
		Number of Missing Observations	1
Minimum	3.4	Mean	1110
Maximum	6400	Median	42.5
SD	2267	Std. Error of Mean	801.5
Coefficient of Variation	2.042	Skewness	2.322

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.587	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.409	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2629	95% Adjusted-CLT UCL (Chen-1995)	3132
		95% Modified-t UCL (Johnson-1978)	2739

Gamma GOF Test

A-D Test Statistic	0.688	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.813	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.276	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.319	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.259	k star (bias corrected MLE)	0.245
Theta hat (MLE)	4292	Theta star (bias corrected MLE)	4532
nu hat (MLE)	4.139	nu star (bias corrected)	3.92
MLE Mean (bias corrected)	1110	MLE Sd (bias corrected)	2243
		Approximate Chi Square Value (0.05)	0.69
Adjusted Level of Significance	0.0195	Adjusted Chi Square Value	0.42

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	6305	95% Adjusted Gamma UCL (use when n<50)	10355

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.818	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.283	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.224	Mean of logged Data	4.282
Maximum of Logged Data	8.764	SD of logged Data	2.767

Assuming Lognormal Distribution

95% H-UCL	20316853	90% Chebyshev (MVUE) UCL	3496
95% Chebyshev (MVUE) UCL	4628	97.5% Chebyshev (MVUE) UCL	6200
99% Chebyshev (MVUE) UCL	9286		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2429	95% Jackknife UCL	2629
95% Standard Bootstrap UCL	2319	95% Bootstrap-t UCL	42065
95% Hall's Bootstrap UCL	24086	95% Percentile Bootstrap UCL	2442
95% BCA Bootstrap UCL	2977		
90% Chebyshev(Mean, Sd) UCL	3515	95% Chebyshev(Mean, Sd) UCL	4604
97.5% Chebyshev(Mean, Sd) UCL	6116	99% Chebyshev(Mean, Sd) UCL	9085

Suggested UCL to Use

95% Adjusted Gamma UCL	10355

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Number of Detects	3	Number of Non-Detects	4
Number of Distinct Detects	3	Number of Distinct Non-Detects	4
Minimum Detect	1.6	Minimum Non-Detect	1.1
Maximum Detect	410	Maximum Non-Detect	270
Variance Detects	50972	Percent Non-Detects	57.14%
Mean Detects	150.2	SD Detects	225.8
Median Detects	39	CV Detects	1.503
Skewness Detects	1.679	Kurtosis Detects	N/A
Mean of Logged Detects	3.383	SD of Logged Detects	2.784

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.818	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.355	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	66.18	KM Standard Error of Mean	65.36
KM SD	141.1	95% KM (BCA) UCL	N/A
95% KM (t) UCL	193.2	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	173.7	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	262.3	95% KM Chebyshev UCL	351.1
97.5% KM Chebyshev UCL	474.3	99% KM Chebyshev UCL	716.5

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.403	k star (bias corrected MLE)	N/A
Theta hat (MLE)	372.3	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	2.421	nu star (bias corrected)	N/A
Mean (detects)	150.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	64.38
Maximum	410	Median	0.01
SD	153.1	CV	2.378
k hat (MLE)	0.145	k star (bias corrected MLE)	0.178
Theta hat (MLE)	445.4	Theta star (bias corrected MLE)	362
nu hat (MLE)	2.023	nu star (bias corrected)	2.49
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (2.49, α)	0.239	Adjusted Chi Square Value (2.49, β)	0.127
95% Gamma Approximate UCL (use when n>=50)	671.2	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	66.18	SD (KM)	141.1
Variance (KM)	19896	SE of Mean (KM)	65.36
k hat (KM)	0.22	k star (KM)	0.221
nu hat (KM)	3.082	nu star (KM)	3.095
theta hat (KM)	300.6	theta star (KM)	299.4
80% gamma percentile (KM)	91.53	90% gamma percentile (KM)	199.9
95% gamma percentile (KM)	331.9	99% gamma percentile (KM)	689.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.09, α)	0.401	Adjusted Chi Square Value (3.09, β)	0.207
95% Gamma Approximate KM-UCL (use when n>=50)	510.8	95% Gamma Adjusted KM-UCL (use when n<50)	989.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.992	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	64.59	Mean in Log Scale	0.652
SD in Original Scale	153	SD in Log Scale	3.149
95% t UCL (assumes normality of ROS data)	176.9	95% Percentile Bootstrap UCL	176
95% BCA Bootstrap UCL	234.4	95% Bootstrap t UCL	17326
95% H-UCL (Log ROS)	1.806E+8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.681	KM Geo Mean	5.373
KM SD (logged)	2.173	95% Critical H Value (KM-Log)	7.296
KM Standard Error of Mean (logged)	1.042	95% H-UCL (KM -Log)	36931
KM SD (logged)	2.173	95% Critical H Value (KM-Log)	7.296
KM Standard Error of Mean (logged)	1.042		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	85.81	Mean in Log Scale	2.63
SD in Original Scale	150.8	SD in Log Scale	2.369
95% t UCL (Assumes normality)	196.6	95% H-Stat UCL	486704

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	193.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	59	Mean	605.6
Maximum	1700	Median	330
SD	604.2	Std. Error of Mean	228.4
Coefficient of Variation	0.998	Skewness	1.068

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1049	95% Adjusted-CLT UCL (Chen-1995)	1080
		95% Modified-t UCL (Johnson-1978)	1065

Gamma GOF Test

A-D Test Statistic	0.256	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.183	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.319	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.035	k star (bias corrected MLE)	0.687
Theta hat (MLE)	584.8	Theta star (bias corrected MLE)	881.6
nu hat (MLE)	14.5	nu star (bias corrected)	9.617
MLE Mean (bias corrected)	605.6	MLE Sd (bias corrected)	730.7
		Approximate Chi Square Value (0.05)	3.704
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2.684

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1572	95% Adjusted Gamma UCL (use when n<50)	2170

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.078	Mean of logged Data	5.851
Maximum of Logged Data	7.438	SD of logged Data	1.238

Assuming Lognormal Distribution

95% H-UCL	6870	90% Chebyshev (MVUE) UCL	1533
95% Chebyshev (MVUE) UCL	1938	97.5% Chebyshev (MVUE) UCL	2500
99% Chebyshev (MVUE) UCL	3603		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	981.2	95% Jackknife UCL	1049
95% Standard Bootstrap UCL	953.1	95% Bootstrap-t UCL	1285
95% Hall's Bootstrap UCL	981.7	95% Percentile Bootstrap UCL	972.7
95% BCA Bootstrap UCL	1063		
90% Chebyshev(Mean, Sd) UCL	1291	95% Chebyshev(Mean, Sd) UCL	1601
97.5% Chebyshev(Mean, Sd) UCL	2032	99% Chebyshev(Mean, Sd) UCL	2878

Suggested UCL to Use

95% Student's-t UCL	1049

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
		Number of Missing Observations	2
Minimum	39	Mean	647
Maximum	2000	Median	260
SD	695.4	Std. Error of Mean	262.8
Coefficient of Variation	1.075	Skewness	1.419

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.831	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1158	95% Adjusted-CLT UCL (Chen-1995)	1230
		95% Modified-t UCL (Johnson-1978)	1181

Gamma GOF Test

A-D Test Statistic	0.27	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.227	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.32	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.938	k star (bias corrected MLE)	0.631
Theta hat (MLE)	689.9	Theta star (bias corrected MLE)	1025
nu hat (MLE)	13.13	nu star (bias corrected)	8.835
MLE Mean (bias corrected)	647	MLE Sd (bias corrected)	814.4
		Approximate Chi Square Value (0.05)	3.228
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2.294

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1771	95% Adjusted Gamma UCL (use when n<50)	2492

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.664	Mean of logged Data	5.852
Maximum of Logged Data	7.601	SD of logged Data	1.336

Assuming Lognormal Distribution

95% H-UCL	10950	90% Chebyshev (MVUE) UCL	1758
95% Chebyshev (MVUE) UCL	2235	97.5% Chebyshev (MVUE) UCL	2898
99% Chebyshev (MVUE) UCL	4200		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1079	95% Jackknife UCL	1158
95% Standard Bootstrap UCL	1046	95% Bootstrap-t UCL	1527
95% Hall's Bootstrap UCL	1279	95% Percentile Bootstrap UCL	1061
95% BCA Bootstrap UCL	1176		
90% Chebyshev(Mean, Sd) UCL	1436	95% Chebyshev(Mean, Sd) UCL	1793
97.5% Chebyshev(Mean, Sd) UCL	2288	99% Chebyshev(Mean, Sd) UCL	3262

Suggested UCL to Use

95% Student's-t UCL	1158

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	61	Mean	960.1
Maximum	3000	Median	430
SD	1011	Std. Error of Mean	382.1
Coefficient of Variation	1.053	Skewness	1.636

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.813	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.271	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1703	95% Adjusted-CLT UCL (Chen-1995)	1841
		95% Modified-t UCL (Johnson-1978)	1742

Gamma GOF Test

A-D Test Statistic	0.3	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.319	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.049	k star (bias corrected MLE)	0.695
Theta hat (MLE)	914.9	Theta star (bias corrected MLE)	1382
nu hat (MLE)	14.69	nu star (bias corrected)	9.729
MLE Mean (bias corrected)	960.1	MLE Sd (bias corrected)	1152
		Approximate Chi Square Value (0.05)	3.773
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2.741

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2476	95% Adjusted Gamma UCL (use when n<50)	3408

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.111	Mean of logged Data	6.32
Maximum of Logged Data	8.006	SD of logged Data	1.256

Assuming Lognormal Distribution

95% H-UCL	11916	90% Chebyshev (MVUE) UCL	2512
95% Chebyshev (MVUE) UCL	3178	97.5% Chebyshev (MVUE) UCL	4103
99% Chebyshev (MVUE) UCL	5920		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1589	95% Jackknife UCL	1703
95% Standard Bootstrap UCL	1543	95% Bootstrap-t UCL	2402
95% Hall's Bootstrap UCL	3603	95% Percentile Bootstrap UCL	1613
95% BCA Bootstrap UCL	1749		
90% Chebyshev(Mean, Sd) UCL	2106	95% Chebyshev(Mean, Sd) UCL	2626
97.5% Chebyshev(Mean, Sd) UCL	3346	99% Chebyshev(Mean, Sd) UCL	4762

Suggested UCL to Use

95% Student's-t UCL	1703

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Number of Detects	4	Number of Non-Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	60	Minimum Non-Detect	29
Maximum Detect	120	Maximum Non-Detect	130
Variance Detects	694.9	Percent Non-Detects	42.86%
Mean Detects	81.75	SD Detects	26.36
Median Detects	73.5	CV Detects	0.322
Skewness Detects	1.61	Kurtosis Detects	2.92
Mean of Logged Detects	4.369	SD of Logged Detects	0.296

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	69.17	KM Standard Error of Mean	13.86
KM SD	28.19	95% KM (BCA) UCL	N/A
95% KM (t) UCL	96.1	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	91.96	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	110.7	95% KM Chebyshev UCL	129.6
97.5% KM Chebyshev UCL	155.7	99% KM Chebyshev UCL	207.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.413	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.324	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	14.51	k star (bias corrected MLE)	3.794
Theta hat (MLE)	5.634	Theta star (bias corrected MLE)	21.55
nu hat (MLE)	116.1	nu star (bias corrected)	30.35
Mean (detects)	81.75		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	32.21	Mean	69.76
Maximum	120	Median	67.84
SD	26.28	CV	0.377
k hat (MLE)	8.202	k star (bias corrected MLE)	4.782
Theta hat (MLE)	8.505	Theta star (bias corrected MLE)	14.59
nu hat (MLE)	114.8	nu star (bias corrected)	66.95
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (66.95, α)	49.12	Adjusted Chi Square Value (66.95, β)	44.54
95% Gamma Approximate UCL (use when n>=50)	95.09	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	69.17	SD (KM)	28.19
Variance (KM)	794.7	SE of Mean (KM)	13.86
k hat (KM)	6.02	k star (KM)	3.535
nu hat (KM)	84.28	nu star (KM)	49.49
theta hat (KM)	11.49	theta star (KM)	19.57
80% gamma percentile (KM)	96.75	90% gamma percentile (KM)	118.5
95% gamma percentile (KM)	138.6	99% gamma percentile (KM)	181.9

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (49.49, α)	34.34	Adjusted Chi Square Value (49.49, β)	30.58
95% Gamma Approximate KM-UCL (use when n>=50)	99.68	95% Gamma Adjusted KM-UCL (use when n<50)	112

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	71.18	Mean in Log Scale	4.22
SD in Original Scale	24.22	SD in Log Scale	0.319
95% t UCL (assumes normality of ROS data)	88.97	95% Percentile Bootstrap UCL	87.28
95% BCA Bootstrap UCL	89.83	95% Bootstrap t UCL	98.42
95% H-UCL (Log ROS)	95.88		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.143	KM Geo Mean	62.97
KM SD (logged)	0.453	95% Critical H Value (KM-Log)	2.365
KM Standard Error of Mean (logged)	0.229	95% H-UCL (KM -Log)	108.1
KM SD (logged)	0.453	95% Critical H Value (KM-Log)	2.365
KM Standard Error of Mean (logged)	0.229		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	65.93	Mean in Log Scale	4.047
SD in Original Scale	31.23	SD in Log Scale	0.656
95% t UCL (Assumes normality)	88.86	95% H-Stat UCL	150.1

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	96.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Number of Detects	4	Number of Non-Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	91	Minimum Non-Detect	11
Maximum Detect	510	Maximum Non-Detect	47
Variance Detects	31847	Percent Non-Detects	42.86%
Mean Detects	257.8	SD Detects	178.5
Median Detects	215	CV Detects	0.692
Skewness Detects	1.314	Kurtosis Detects	2.386
Mean of Logged Detects	5.37	SD of Logged Detects	0.706

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	152	KM Standard Error of Mean	73.76
KM SD	169	95% KM (BCA) UCL	N/A
95% KM (t) UCL	295.3	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	273.3	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	373.3	95% KM Chebyshev UCL	473.5
97.5% KM Chebyshev UCL	612.6	99% KM Chebyshev UCL	885.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.272	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.66	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.247	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.397	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.91	k star (bias corrected MLE)	0.894
Theta hat (MLE)	88.58	Theta star (bias corrected MLE)	288.3
nu hat (MLE)	23.28	nu star (bias corrected)	7.153
Mean (detects)	257.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	147.3
Maximum	510	Median	91
SD	186.8	CV	1.268
k hat (MLE)	0.19	k star (bias corrected MLE)	0.204
Theta hat (MLE)	774	Theta star (bias corrected MLE)	722.1
nu hat (MLE)	2.664	nu star (bias corrected)	2.856
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (2.86, α)	0.331	Adjusted Chi Square Value (2.86, β)	0.17
95% Gamma Approximate UCL (use when n>=50)	1271	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	152	SD (KM)	169
Variance (KM)	28559	SE of Mean (KM)	73.76
k hat (KM)	0.809	k star (KM)	0.558
nu hat (KM)	11.33	nu star (KM)	7.805
theta hat (KM)	187.9	theta star (KM)	272.6
80% gamma percentile (KM)	250.4	90% gamma percentile (KM)	401.8
95% gamma percentile (KM)	561.6	99% gamma percentile (KM)	950.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.81, α)	2.623	Adjusted Chi Square Value (7.81, β)	1.807
95% Gamma Approximate KM-UCL (use when n>=50)	452.3	95% Gamma Adjusted KM-UCL (use when n<50)	656.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	159.2	Mean in Log Scale	4.492
SD in Original Scale	176.2	SD in Log Scale	1.204
95% t UCL (assumes normality of ROS data)	288.6	95% Percentile Bootstrap UCL	268.1
95% BCA Bootstrap UCL	301.7	95% Bootstrap t UCL	386.2
95% H-UCL (Log ROS)	1515		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.096	KM Geo Mean	60.13
KM SD (logged)	1.542	95% Critical H Value (KM-Log)	5.313
KM Standard Error of Mean (logged)	0.673	95% H-UCL (KM -Log)	5594
KM SD (logged)	1.542	95% Critical H Value (KM-Log)	5.313
KM Standard Error of Mean (logged)	0.673		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	152.9	Mean in Log Scale	4.092
SD in Original Scale	181.8	SD in Log Scale	1.723
95% t UCL (Assumes normality)	286.4	95% H-Stat UCL	16449

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	295.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	18	Mean	524
Maximum	1700	Median	320
SD	582.5	Std. Error of Mean	220.2
Coefficient of Variation	1.112	Skewness	1.628

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.829	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	951.8	95% Adjusted-CLT UCL (Chen-1995)	1031
		95% Modified-t UCL (Johnson-1978)	974.4

Gamma GOF Test

A-D Test Statistic	0.176	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.142	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.322	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.843	k star (bias corrected MLE)	0.577
Theta hat (MLE)	621.6	Theta star (bias corrected MLE)	908.2
nu hat (MLE)	11.8	nu star (bias corrected)	8.078
MLE Mean (bias corrected)	524	MLE Sd (bias corrected)	689.9
		Approximate Chi Square Value (0.05)	2.78
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	1.933

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1523	95% Adjusted Gamma UCL (use when n<50)	2190

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.16	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.89	Mean of logged Data	5.562
Maximum of Logged Data	7.438	SD of logged Data	1.497

Assuming Lognormal Distribution

95% H-UCL	18885	90% Chebyshev (MVUE) UCL	1648
95% Chebyshev (MVUE) UCL	2114	97.5% Chebyshev (MVUE) UCL	2761
99% Chebyshev (MVUE) UCL	4030		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	886.1	95% Jackknife UCL	951.8
95% Standard Bootstrap UCL	848.1	95% Bootstrap-t UCL	1283
95% Hall's Bootstrap UCL	2201	95% Percentile Bootstrap UCL	895.7
95% BCA Bootstrap UCL	965.7		
90% Chebyshev(Mean, Sd) UCL	1184	95% Chebyshev(Mean, Sd) UCL	1484
97.5% Chebyshev(Mean, Sd) UCL	1899	99% Chebyshev(Mean, Sd) UCL	2714

Suggested UCL to Use

95% Student's-t UCL	951.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	4000	Mean	6586
Maximum	9200	Median	6800
SD	1963	Std. Error of Mean	741.8
Coefficient of Variation	0.298	Skewness	-0.188

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8027	95% Adjusted-CLT UCL (Chen-1995)	7750
		95% Modified-t UCL (Johnson-1978)	8018

Gamma GOF Test

A-D Test Statistic	0.308	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.708	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.187	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.312	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	12.11	k star (bias corrected MLE)	7.016
Theta hat (MLE)	543.8	Theta star (bias corrected MLE)	938.7
nu hat (MLE)	169.5	nu star (bias corrected)	98.22
MLE Mean (bias corrected)	6586	MLE Sd (bias corrected)	2486
		Approximate Chi Square Value (0.05)	76.36
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	70.55

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8471	95% Adjusted Gamma UCL (use when n<50)	9168

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.171	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.294	Mean of logged Data	8.751
Maximum of Logged Data	9.127	SD of logged Data	0.32

Assuming Lognormal Distribution

95% H-UCL	8912	90% Chebyshev (MVUE) UCL	9000
95% Chebyshev (MVUE) UCL	10088	97.5% Chebyshev (MVUE) UCL	11598
99% Chebyshev (MVUE) UCL	14564		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7806	95% Jackknife UCL	8027
95% Standard Bootstrap UCL	7718	95% Bootstrap-t UCL	7851
95% Hall's Bootstrap UCL	7580	95% Percentile Bootstrap UCL	7786
95% BCA Bootstrap UCL	7643		
90% Chebyshev(Mean, Sd) UCL	8811	95% Chebyshev(Mean, Sd) UCL	9819
97.5% Chebyshev(Mean, Sd) UCL	11218	99% Chebyshev(Mean, Sd) UCL	13966

Suggested UCL to Use

95% Student's-t UCL	8027

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	1.2	Mean	6.914
Maximum	13	Median	8.5
SD	4.839	Std. Error of Mean	1.829
Coefficient of Variation	0.7	Skewness	-0.114

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.88	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	10.47	95% Adjusted-CLT UCL (Chen-1995)	9.838
		95% Modified-t UCL (Johnson-1978)	10.46

Gamma GOF Test

A-D Test Statistic	0.541	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.316	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.685	k star (bias corrected MLE)	1.058
Theta hat (MLE)	4.103	Theta star (bias corrected MLE)	6.534
nu hat (MLE)	23.59	nu star (bias corrected)	14.82
MLE Mean (bias corrected)	6.914	MLE Sd (bias corrected)	6.721
		Approximate Chi Square Value (0.05)	7.134
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	5.604

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	14.36	95% Adjusted Gamma UCL (use when n<50)	18.28

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.86	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.28	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.182	Mean of logged Data	1.608
Maximum of Logged Data	2.565	SD of logged Data	0.967

Assuming Lognormal Distribution

95% H-UCL	33.04	90% Chebyshev (MVUE) UCL	15.38
95% Chebyshev (MVUE) UCL	19.03	97.5% Chebyshev (MVUE) UCL	24.1
99% Chebyshev (MVUE) UCL	34.06		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	9.923	95% Jackknife UCL	10.47
95% Standard Bootstrap UCL	9.692	95% Bootstrap-t UCL	10.27
95% Hall's Bootstrap UCL	9.045	95% Percentile Bootstrap UCL	9.557
95% BCA Bootstrap UCL	9.686		
90% Chebyshev(Mean, Sd) UCL	12.4	95% Chebyshev(Mean, Sd) UCL	14.89
97.5% Chebyshev(Mean, Sd) UCL	18.34	99% Chebyshev(Mean, Sd) UCL	25.11

Suggested UCL to Use

95% Student's-t UCL	10.47

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	8.3	Mean	18.33
Maximum	33	Median	17
SD	8.731	Std. Error of Mean	3.3
Coefficient of Variation	0.476	Skewness	0.57

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	24.74	95% Adjusted-CLT UCL (Chen-1995)	24.52
		95% Modified-t UCL (Johnson-1978)	24.86

Gamma GOF Test

A-D Test Statistic	0.244	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.182	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.963	k star (bias corrected MLE)	2.931
Theta hat (MLE)	3.693	Theta star (bias corrected MLE)	6.253
nu hat (MLE)	69.48	nu star (bias corrected)	41.04
MLE Mean (bias corrected)	18.33	MLE Sd (bias corrected)	10.71
		Approximate Chi Square Value (0.05)	27.36
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	24.04

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	27.5	95% Adjusted Gamma UCL (use when n<50)	31.29

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.189	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.116	Mean of logged Data	2.804
Maximum of Logged Data	3.497	SD of logged Data	0.505

Assuming Lognormal Distribution

95% H-UCL	31.26	90% Chebyshev (MVUE) UCL	28.99
95% Chebyshev (MVUE) UCL	33.79	97.5% Chebyshev (MVUE) UCL	40.45
99% Chebyshev (MVUE) UCL	53.53		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	23.76	95% Jackknife UCL	24.74
95% Standard Bootstrap UCL	23.32	95% Bootstrap-t UCL	25.84
95% Hall's Bootstrap UCL	28.29	95% Percentile Bootstrap UCL	23.57
95% BCA Bootstrap UCL	23.86		
90% Chebyshev(Mean, Sd) UCL	28.23	95% Chebyshev(Mean, Sd) UCL	32.71
97.5% Chebyshev(Mean, Sd) UCL	38.94	99% Chebyshev(Mean, Sd) UCL	51.16

Suggested UCL to Use

95% Student's-t UCL	24.74

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	160	Mean	1137
Maximum	3100	Median	260
SD	1293	Std. Error of Mean	488.7
Coefficient of Variation	1.137	Skewness	0.973

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.757	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.323	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2087	95% Adjusted-CLT UCL (Chen-1995)	2133
		95% Modified-t UCL (Johnson-1978)	2117

Gamma GOF Test

A-D Test Statistic	0.724	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.334	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.321	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.862	k star (bias corrected MLE)	0.588
Theta hat (MLE)	1319	Theta star (bias corrected MLE)	1934
nu hat (MLE)	12.07	nu star (bias corrected)	8.23
MLE Mean (bias corrected)	1137	MLE Sd (bias corrected)	1483
		Approximate Chi Square Value (0.05)	2.869
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2.004

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	3262	95% Adjusted Gamma UCL (use when n<50)	4670

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.823	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.302	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.075	Mean of logged Data	6.354
Maximum of Logged Data	8.039	SD of logged Data	1.293

Assuming Lognormal Distribution

95% H-UCL	14681	90% Chebyshev (MVUE) UCL	2736
95% Chebyshev (MVUE) UCL	3470	97.5% Chebyshev (MVUE) UCL	4489
99% Chebyshev (MVUE) UCL	6491		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1941	95% Jackknife UCL	2087
95% Standard Bootstrap UCL	1887	95% Bootstrap-t UCL	3832
95% Hall's Bootstrap UCL	2498	95% Percentile Bootstrap UCL	1903
95% BCA Bootstrap UCL	2109		
90% Chebyshev(Mean, Sd) UCL	2603	95% Chebyshev(Mean, Sd) UCL	3267
97.5% Chebyshev(Mean, Sd) UCL	4189	99% Chebyshev(Mean, Sd) UCL	5999

Suggested UCL to Use

95% Adjusted Gamma UCL	4670

Recommended UCL exceeds the maximum observation

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	0.63	Mean	5.69
Maximum	11	Median	5.9
SD	4.136	Std. Error of Mean	1.563
Coefficient of Variation	0.727	Skewness	-0.117

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8.728	95% Adjusted-CLT UCL (Chen-1995)	8.188
		95% Modified-t UCL (Johnson-1978)	8.716

Gamma GOF Test

A-D Test Statistic	0.501	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.724	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.21	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.318	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.306	k star (bias corrected MLE)	0.842
Theta hat (MLE)	4.356	Theta star (bias corrected MLE)	6.76
nu hat (MLE)	18.29	nu star (bias corrected)	11.78
MLE Mean (bias corrected)	5.69	MLE Sd (bias corrected)	6.202
		Approximate Chi Square Value (0.05)	5.085
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	3.841

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	13.19	95% Adjusted Gamma UCL (use when n<50)	17.46

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.829	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.462	Mean of logged Data	1.309
Maximum of Logged Data	2.398	SD of logged Data	1.185

Assuming Lognormal Distribution

95% H-UCL	57.92	90% Chebyshev (MVUE) UCL	15.21
95% Chebyshev (MVUE) UCL	19.16	97.5% Chebyshev (MVUE) UCL	24.64
99% Chebyshev (MVUE) UCL	35.4		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8.261	95% Jackknife UCL	8.728
95% Standard Bootstrap UCL	8.076	95% Bootstrap-t UCL	8.829
95% Hall's Bootstrap UCL	7.804	95% Percentile Bootstrap UCL	8.061
95% BCA Bootstrap UCL	8.19		
90% Chebyshev(Mean, Sd) UCL	10.38	95% Chebyshev(Mean, Sd) UCL	12.5
97.5% Chebyshev(Mean, Sd) UCL	15.45	99% Chebyshev(Mean, Sd) UCL	21.24

Suggested UCL to Use

95% Student's-t UCL	8.728

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Number of Detects	4	Number of Non-Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	0.55	Minimum Non-Detect	0.28
Maximum Detect	1.2	Maximum Non-Detect	1.3
Variance Detects	0.0886	Percent Non-Detects	42.86%
Mean Detects	0.835	SD Detects	0.298
Median Detects	0.795	CV Detects	0.356
Skewness Detects	0.495	Kurtosis Detects	-2.465
Mean of Logged Detects	-0.228	SD of Logged Detects	0.358

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.65	KM Standard Error of Mean	0.158
KM SD	0.336	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.958	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.91	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.125	95% KM Chebyshev UCL	1.34
97.5% KM Chebyshev UCL	1.638	99% KM Chebyshev UCL	2.225

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.295	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.265	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.59	k star (bias corrected MLE)	2.815
Theta hat (MLE)	0.0788	Theta star (bias corrected MLE)	0.297
nu hat (MLE)	84.73	nu star (bias corrected)	22.52
Mean (detects)	0.835		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.116	Mean	0.591
Maximum	1.2	Median	0.566
SD	0.399	CV	0.675
k hat (MLE)	1.803	k star (bias corrected MLE)	1.126
Theta hat (MLE)	0.328	Theta star (bias corrected MLE)	0.525
nu hat (MLE)	25.24	nu star (bias corrected)	15.76
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (15.76, α)	7.791	Adjusted Chi Square Value (15.76, β)	6.179
95% Gamma Approximate UCL (use when n>=50)	1.195	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.65	SD (KM)	0.336
Variance (KM)	0.113	SE of Mean (KM)	0.158
k hat (KM)	3.748	k star (KM)	2.237
nu hat (KM)	52.47	nu star (KM)	31.32
theta hat (KM)	0.173	theta star (KM)	0.291
80% gamma percentile (KM)	0.96	90% gamma percentile (KM)	1.232
95% gamma percentile (KM)	1.489	99% gamma percentile (KM)	2.055

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (31.32, α)	19.53	Adjusted Chi Square Value (31.32, β)	16.78
95% Gamma Approximate KM-UCL (use when n>=50)	1.042	95% Gamma Adjusted KM-UCL (use when n<50)	1.213

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.643	Mean in Log Scale	-0.559
SD in Original Scale	0.332	SD in Log Scale	0.532
95% t UCL (assumes normality of ROS data)	0.887	95% Percentile Bootstrap UCL	0.849
95% BCA Bootstrap UCL	0.857	95% Bootstrap t UCL	1.03
95% H-UCL (Log ROS)	1.142		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.577	KM Geo Mean	0.562
KM SD (logged)	0.554	95% Critical H Value (KM-Log)	2.573
KM Standard Error of Mean (logged)	0.261	95% H-UCL (KM -Log)	1.172
KM SD (logged)	0.554	95% Critical H Value (KM-Log)	2.573
KM Standard Error of Mean (logged)	0.261		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.614	Mean in Log Scale	-0.73
SD in Original Scale	0.385	SD in Log Scale	0.832
95% t UCL (Assumes normality)	0.896	95% H-Stat UCL	2.048

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.958

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	5.1	Mean	10.79
Maximum	17	Median	12
SD	4.976	Std. Error of Mean	1.881
Coefficient of Variation	0.461	Skewness	-0.0185

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	14.44	95% Adjusted-CLT UCL (Chen-1995)	13.87
		95% Modified-t UCL (Johnson-1978)	14.44

Gamma GOF Test

A-D Test Statistic	0.458	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.223	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.891	k star (bias corrected MLE)	2.89
Theta hat (MLE)	2.205	Theta star (bias corrected MLE)	3.732
nu hat (MLE)	68.47	nu star (bias corrected)	40.46
MLE Mean (bias corrected)	10.79	MLE Sd (bias corrected)	6.345
		Approximate Chi Square Value (0.05)	26.88
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	23.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	16.23	95% Adjusted Gamma UCL (use when n<50)	18.49

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.629	Mean of logged Data	2.273
Maximum of Logged Data	2.833	SD of logged Data	0.514

Assuming Lognormal Distribution

95% H-UCL	18.7	90% Chebyshev (MVUE) UCL	17.21
95% Chebyshev (MVUE) UCL	20.09	97.5% Chebyshev (MVUE) UCL	24.09
99% Chebyshev (MVUE) UCL	31.95		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13.88	95% Jackknife UCL	14.44
95% Standard Bootstrap UCL	13.64	95% Bootstrap-t UCL	14.52
95% Hall's Bootstrap UCL	13.21	95% Percentile Bootstrap UCL	13.6
95% BCA Bootstrap UCL	13.63		
90% Chebyshev(Mean, Sd) UCL	16.43	95% Chebyshev(Mean, Sd) UCL	18.98
97.5% Chebyshev(Mean, Sd) UCL	22.53	99% Chebyshev(Mean, Sd) UCL	29.5

Suggested UCL to Use

95% Student's-t UCL	14.44

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	62	Mean	1110
Maximum	2400	Median	1300
SD	870.7	Std. Error of Mean	329.1
Coefficient of Variation	0.784	Skewness	0.145

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1750	95% Adjusted-CLT UCL (Chen-1995)	1671
		95% Modified-t UCL (Johnson-1978)	1753

Gamma GOF Test

A-D Test Statistic	0.38	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.726	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.258	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.319	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.127	k star (bias corrected MLE)	0.739
Theta hat (MLE)	985.3	Theta star (bias corrected MLE)	1502
nu hat (MLE)	15.78	nu star (bias corrected)	10.35
MLE Mean (bias corrected)	1110	MLE Sd (bias corrected)	1291
		Approximate Chi Square Value (0.05)	4.161
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	3.063

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2761	95% Adjusted Gamma UCL (use when n<50)	3751

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.264	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.127	Mean of logged Data	6.507
Maximum of Logged Data	7.783	SD of logged Data	1.321

Assuming Lognormal Distribution

95% H-UCL	19555	90% Chebyshev (MVUE) UCL	3313
95% Chebyshev (MVUE) UCL	4209	97.5% Chebyshev (MVUE) UCL	5452
99% Chebyshev (MVUE) UCL	7895		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1652	95% Jackknife UCL	1750
95% Standard Bootstrap UCL	1612	95% Bootstrap-t UCL	1777
95% Hall's Bootstrap UCL	1589	95% Percentile Bootstrap UCL	1637
95% BCA Bootstrap UCL	1623		
90% Chebyshev(Mean, Sd) UCL	2098	95% Chebyshev(Mean, Sd) UCL	2545
97.5% Chebyshev(Mean, Sd) UCL	3165	99% Chebyshev(Mean, Sd) UCL	4385

Suggested UCL to Use

95% Student's-t UCL	1750

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Number of Detects	4	Number of Non-Detects	3
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	0.56	Minimum Non-Detect	0.21
Maximum Detect	13	Maximum Non-Detect	0.29
Variance Detects	34.87	Percent Non-Detects	42.86%
Mean Detects	4.26	SD Detects	5.905
Median Detects	1.74	CV Detects	1.386
Skewness Detects	1.849	Kurtosis Detects	3.425
Mean of Logged Detects	0.682	SD of Logged Detects	1.426

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.752	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.354	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.524	KM Standard Error of Mean	1.901
KM SD	4.355	95% KM (BCA) UCL	N/A
95% KM (t) UCL	6.217	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	5.65	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	8.226	95% KM Chebyshev UCL	10.81
97.5% KM Chebyshev UCL	14.39	99% KM Chebyshev UCL	21.43

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.403	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.67	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.277	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.405	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.777	k star (bias corrected MLE)	0.361
Theta hat (MLE)	5.483	Theta star (bias corrected MLE)	11.8
nu hat (MLE)	6.216	nu star (bias corrected)	2.887
Mean (detects)	4.26		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.439
Maximum	13	Median	0.56
SD	4.754	CV	1.949
k hat (MLE)	0.282	k star (bias corrected MLE)	0.256
Theta hat (MLE)	8.663	Theta star (bias corrected MLE)	9.522
nu hat (MLE)	3.941	nu star (bias corrected)	3.585
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (3.59, α)	0.565	Adjusted Chi Square Value (3.59, β)	0.302
95% Gamma Approximate UCL (use when n>=50)	15.47	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.524	SD (KM)	4.355
Variance (KM)	18.96	SE of Mean (KM)	1.901
k hat (KM)	0.336	k star (KM)	0.287
nu hat (KM)	4.704	nu star (KM)	4.022
theta hat (KM)	7.512	theta star (KM)	8.788
80% gamma percentile (KM)	3.828	90% gamma percentile (KM)	7.482
95% gamma percentile (KM)	11.71	99% gamma percentile (KM)	22.75

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.02, α)	0.73	Adjusted Chi Square Value (4.02, β)	0.405
95% Gamma Approximate KM-UCL (use when n>=50)	13.9	95% Gamma Adjusted KM-UCL (use when n<50)	25.08

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.243	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.447	Mean in Log Scale	-1.117
SD in Original Scale	4.749	SD in Log Scale	2.46
95% t UCL (assumes normality of ROS data)	5.935	95% Percentile Bootstrap UCL	5.74
95% BCA Bootstrap UCL	6.733	95% Bootstrap t UCL	33.43
95% H-UCL (Log ROS)	25720		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.279	KM Geo Mean	0.757
KM SD (logged)	1.45	95% Critical H Value (KM-Log)	5.031
KM Standard Error of Mean (logged)	0.633	95% H-UCL (KM -Log)	42.61
KM SD (logged)	1.45	95% Critical H Value (KM-Log)	5.031
KM Standard Error of Mean (logged)	0.633		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.486	Mean in Log Scale	-0.517
SD in Original Scale	4.725	SD in Log Scale	1.806
95% t UCL (Assumes normality)	5.957	95% H-Stat UCL	281.6

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	6.217

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	16000	Mean	48286
Maximum	71000	Median	58000
SD	21313	Std. Error of Mean	8056
Coefficient of Variation	0.441	Skewness	-0.895

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	63939	95% Adjusted-CLT UCL (Chen-1995)	58624
		95% Modified-t UCL (Johnson-1978)	63485

Gamma GOF Test

A-D Test Statistic	0.783	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.71	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.307	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.2	k star (bias corrected MLE)	2.495
Theta hat (MLE)	11497	Theta star (bias corrected MLE)	19351
nu hat (MLE)	58.8	nu star (bias corrected)	34.93
MLE Mean (bias corrected)	48286	MLE Sd (bias corrected)	30568
		Approximate Chi Square Value (0.05)	22.41
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	19.44

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	75263	95% Adjusted Gamma UCL (use when n<50)	86763

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.783	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.32	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.68	Mean of logged Data	10.66
Maximum of Logged Data	11.17	SD of logged Data	0.591

Assuming Lognormal Distribution

95% H-UCL	96476	90% Chebyshev (MVUE) UCL	82785
95% Chebyshev (MVUE) UCL	97893	97.5% Chebyshev (MVUE) UCL	118861
99% Chebyshev (MVUE) UCL	160049		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	61536	95% Jackknife UCL	63939
95% Standard Bootstrap UCL	60319	95% Bootstrap-t UCL	61582
95% Hall's Bootstrap UCL	57596	95% Percentile Bootstrap UCL	60000
95% BCA Bootstrap UCL	59000		
90% Chebyshev(Mean, Sd) UCL	72452	95% Chebyshev(Mean, Sd) UCL	83399
97.5% Chebyshev(Mean, Sd) UCL	98592	99% Chebyshev(Mean, Sd) UCL	128437

Suggested UCL to Use

95% Student's-t UCL 63939

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	22	Mean	1525
Maximum	4200	Median	700
SD	1617	Std. Error of Mean	611.1
Coefficient of Variation	1.061	Skewness	0.998

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.266	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2712	95% Adjusted-CLT UCL (Chen-1995)	2776
		95% Modified-t UCL (Johnson-1978)	2751

Gamma GOF Test

A-D Test Statistic	0.219	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.323	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.728	k star (bias corrected MLE)	0.511
Theta hat (MLE)	2094	Theta star (bias corrected MLE)	2982
nu hat (MLE)	10.19	nu star (bias corrected)	7.158
MLE Mean (bias corrected)	1525	MLE Sd (bias corrected)	2132
		Approximate Chi Square Value (0.05)	2.258
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	1.519

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4834	95% Adjusted Gamma UCL (use when n<50)	7182

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.209	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.091	Mean of logged Data	6.504
Maximum of Logged Data	8.343	SD of logged Data	1.774

Assuming Lognormal Distribution

95% H-UCL	254333	90% Chebyshev (MVUE) UCL	6309
95% Chebyshev (MVUE) UCL	8184	97.5% Chebyshev (MVUE) UCL	10787
99% Chebyshev (MVUE) UCL	15899		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2530	95% Jackknife UCL	2712
95% Standard Bootstrap UCL	2453	95% Bootstrap-t UCL	4546
95% Hall's Bootstrap UCL	3728	95% Percentile Bootstrap UCL	2552
95% BCA Bootstrap UCL	2571		
90% Chebyshev(Mean, Sd) UCL	3358	95% Chebyshev(Mean, Sd) UCL	4188
97.5% Chebyshev(Mean, Sd) UCL	5341	99% Chebyshev(Mean, Sd) UCL	7605

Suggested UCL to Use

95% Student's-t UCL	2712

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	4
Minimum	3600	Mean	25300
Maximum	47000	Median	25300

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - coarse fraction was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Lead - fine fraction

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	4
Minimum	3600	Mean	15800
Maximum	28000	Median	15800

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - fine fraction was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	4
Minimum	3600	Mean	23300
Maximum	43000	Median	23300

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - total (calculated by fine/coarse fraction) was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	230	Mean	500
Maximum	880	Median	400
SD	252.6	Std. Error of Mean	95.47
Coefficient of Variation	0.505	Skewness	0.538

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	685.5	95% Adjusted-CLT UCL (Chen-1995)	677.8
		95% Modified-t UCL (Johnson-1978)	688.7

Gamma GOF Test

A-D Test Statistic	0.37	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.609	k star (bias corrected MLE)	2.729
Theta hat (MLE)	108.5	Theta star (bias corrected MLE)	183.2
nu hat (MLE)	64.53	nu star (bias corrected)	38.21
MLE Mean (bias corrected)	500	MLE Sd (bias corrected)	302.7
		Approximate Chi Square Value (0.05)	25.05
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	21.89

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	762.6	95% Adjusted Gamma UCL (use when n<50)	872.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.19	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.438	Mean of logged Data	6.102
Maximum of Logged Data	6.78	SD of logged Data	0.515

Assuming Lognormal Distribution

95% H-UCL	862	90% Chebyshev (MVUE) UCL	793.2
95% Chebyshev (MVUE) UCL	926.1	97.5% Chebyshev (MVUE) UCL	1111
99% Chebyshev (MVUE) UCL	1473		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	657	95% Jackknife UCL	685.5
95% Standard Bootstrap UCL	645	95% Bootstrap-t UCL	755.8
95% Hall's Bootstrap UCL	639.2	95% Percentile Bootstrap UCL	640
95% BCA Bootstrap UCL	668.6		
90% Chebyshev(Mean, Sd) UCL	786.4	95% Chebyshev(Mean, Sd) UCL	916.1
97.5% Chebyshev(Mean, Sd) UCL	1096	99% Chebyshev(Mean, Sd) UCL	1450

Suggested UCL to Use

95% Student's-t UCL	685.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	0.11	Mean	0.251
Maximum	0.49	Median	0.23
SD	0.121	Std. Error of Mean	0.0456
Coefficient of Variation	0.48	Skewness	1.363

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.252	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.34	95% Adjusted-CLT UCL (Chen-1995)	0.352
		95% Modified-t UCL (Johnson-1978)	0.344

Gamma GOF Test

A-D Test Statistic	0.276	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.71	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.201	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.602	k star (bias corrected MLE)	3.296
Theta hat (MLE)	0.0449	Theta star (bias corrected MLE)	0.0763
nu hat (MLE)	78.43	nu star (bias corrected)	46.15
MLE Mean (bias corrected)	0.251	MLE Sd (bias corrected)	0.138
		Approximate Chi Square Value (0.05)	31.56
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	27.97

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.368	95% Adjusted Gamma UCL (use when n<50)	0.415

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.207	Mean of logged Data	-1.472
Maximum of Logged Data	-0.713	SD of logged Data	0.462

Assuming Lognormal Distribution

95% H-UCL	0.4	90% Chebyshev (MVUE) UCL	0.383
95% Chebyshev (MVUE) UCL	0.443	97.5% Chebyshev (MVUE) UCL	0.526
99% Chebyshev (MVUE) UCL	0.689		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.326	95% Jackknife UCL	0.34
95% Standard Bootstrap UCL	0.322	95% Bootstrap-t UCL	0.393
95% Hall's Bootstrap UCL	0.788	95% Percentile Bootstrap UCL	0.324
95% BCA Bootstrap UCL	0.343		
90% Chebyshev(Mean, Sd) UCL	0.388	95% Chebyshev(Mean, Sd) UCL	0.45
97.5% Chebyshev(Mean, Sd) UCL	0.536	99% Chebyshev(Mean, Sd) UCL	0.706

Suggested UCL to Use

95% Student's-t UCL	0.34

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	13	Mean	26.71
Maximum	46	Median	28
SD	11.22	Std. Error of Mean	4.241
Coefficient of Variation	0.42	Skewness	0.64

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	34.96	95% Adjusted-CLT UCL (Chen-1995)	34.79
		95% Modified-t UCL (Johnson-1978)	35.13

Gamma GOF Test

A-D Test Statistic	0.218	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.185	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.313	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.618	k star (bias corrected MLE)	3.877
Theta hat (MLE)	4.036	Theta star (bias corrected MLE)	6.89
nu hat (MLE)	92.66	nu star (bias corrected)	54.28
MLE Mean (bias corrected)	26.71	MLE Sd (bias corrected)	13.57
		Approximate Chi Square Value (0.05)	38.35
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	34.35

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	37.81	95% Adjusted Gamma UCL (use when n<50)	42.21

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.565	Mean of logged Data	3.208
Maximum of Logged Data	3.829	SD of logged Data	0.43

Assuming Lognormal Distribution

95% H-UCL	40.81	90% Chebyshev (MVUE) UCL	39.85
95% Chebyshev (MVUE) UCL	45.78	97.5% Chebyshev (MVUE) UCL	54.02
99% Chebyshev (MVUE) UCL	70.2		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	33.69	95% Jackknife UCL	34.96
95% Standard Bootstrap UCL	33.34	95% Bootstrap-t UCL	35.87
95% Hall's Bootstrap UCL	36.5	95% Percentile Bootstrap UCL	33.14
95% BCA Bootstrap UCL	34.29		
90% Chebyshev(Mean, Sd) UCL	39.44	95% Chebyshev(Mean, Sd) UCL	45.2
97.5% Chebyshev(Mean, Sd) UCL	53.2	99% Chebyshev(Mean, Sd) UCL	68.91

Suggested UCL to Use

95% Student's-t UCL	34.96

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Minimum	58	Mean	1201
Maximum	3000	Median	470
SD	1196	Std. Error of Mean	452.1
Coefficient of Variation	0.996	Skewness	0.581

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2080	95% Adjusted-CLT UCL (Chen-1995)	2051
		95% Modified-t UCL (Johnson-1978)	2096

Gamma GOF Test

A-D Test Statistic	0.417	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.321	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.867	k star (bias corrected MLE)	0.591
Theta hat (MLE)	1385	Theta star (bias corrected MLE)	2033
nu hat (MLE)	12.14	nu star (bias corrected)	8.271
MLE Mean (bias corrected)	1201	MLE Sd (bias corrected)	1563
		Approximate Chi Square Value (0.05)	2.893
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	2.023

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3434	95% Adjusted Gamma UCL (use when n<50)	4911

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.06	Mean of logged Data	6.414
Maximum of Logged Data	8.006	SD of logged Data	1.44

Assuming Lognormal Distribution

95% H-UCL	32462	90% Chebyshev (MVUE) UCL	3561
95% Chebyshev (MVUE) UCL	4554	97.5% Chebyshev (MVUE) UCL	5932
99% Chebyshev (MVUE) UCL	8639		

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1945	95% Jackknife UCL	2080
95% Standard Bootstrap UCL	1902	95% Bootstrap-t UCL	2357
95% Hall's Bootstrap UCL	1709	95% Percentile Bootstrap UCL	1895
95% BCA Bootstrap UCL	1975		
90% Chebyshev(Mean, Sd) UCL	2557	95% Chebyshev(Mean, Sd) UCL	3172
97.5% Chebyshev(Mean, Sd) UCL	4024	99% Chebyshev(Mean, Sd) UCL	5699

Suggested UCL to Use

95% Student's-t UCL	2080

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Number of Detects	1	Number of Non-Detects	6
Number of Distinct Detects	1	Number of Distinct Non-Detects	6

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1242 (PCB-1242) was not processed!

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Number of Detects	5	Number of Non-Detects	2
Number of Distinct Detects	5	Number of Distinct Non-Detects	2
Minimum Detect	54	Minimum Non-Detect	35
Maximum Detect	620	Maximum Non-Detect	510
Variance Detects	53077	Percent Non-Detects	28.57%
Mean Detects	298.6	SD Detects	230.4
Median Detects	330	CV Detects	0.772
Skewness Detects	0.389	Kurtosis Detects	-0.941
Mean of Logged Detects	5.356	SD of Logged Detects	1.021

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	244.2	KM Standard Error of Mean	90.8
KM SD	205.9	95% KM (BCA) UCL	390.6
95% KM (t) UCL	420.7	95% KM (Percentile Bootstrap) UCL	388.4
95% KM (z) UCL	393.6	95% KM Bootstrap t UCL	435.9
90% KM Chebyshev UCL	516.6	95% KM Chebyshev UCL	640
97.5% KM Chebyshev UCL	811.3	99% KM Chebyshev UCL	1148

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.316	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.686	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.253	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.361	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.603	k star (bias corrected MLE)	0.774
Theta hat (MLE)	186.3	Theta star (bias corrected MLE)	385.6
nu hat (MLE)	16.03	nu star (bias corrected)	7.745
Mean (detects)	298.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	235.1
Maximum	620	Median	152.8
SD	221.5	CV	0.942
k hat (MLE)	0.416	k star (bias corrected MLE)	0.333
Theta hat (MLE)	565.8	Theta star (bias corrected MLE)	706.7
nu hat (MLE)	5.817	nu star (bias corrected)	4.658
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (4.66, α)	0.997	Adjusted Chi Square Value (4.66, β)	0.583
95% Gamma Approximate UCL (use when n>=50)	1098	95% Gamma Adjusted UCL (use when n<50)	1878

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	244.2	SD (KM)	205.9
Variance (KM)	42400	SE of Mean (KM)	90.8
k hat (KM)	1.407	k star (KM)	0.899
nu hat (KM)	19.7	nu star (KM)	12.59
theta hat (KM)	173.6	theta star (KM)	271.6
80% gamma percentile (KM)	396.2	90% gamma percentile (KM)	577.2
95% gamma percentile (KM)	759.8	99% gamma percentile (KM)	1187

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.59, α)	5.617	Adjusted Chi Square Value (12.59, β)	4.294
95% Gamma Approximate KM-UCL (use when n>=50)	547.4	95% Gamma Adjusted KM-UCL (use when n<50)	716

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.268	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	233.3	Mean in Log Scale	4.968
SD in Original Scale	220.2	SD in Log Scale	1.146
95% t UCL (assumes normality of ROS data)	395	95% Percentile Bootstrap UCL	357.7
95% BCA Bootstrap UCL	392.4	95% Bootstrap t UCL	483.6
95% H-UCL (Log ROS)	1900		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.016	KM Geo Mean	150.9
KM SD (logged)	1.059	95% Critical H Value (KM-Log)	3.867
KM Standard Error of Mean (logged)	0.478	95% H-UCL (KM -Log)	1408
KM SD (logged)	1.059	95% Critical H Value (KM-Log)	3.867
KM Standard Error of Mean (logged)	0.478		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	252.2	Mean in Log Scale	5.026
SD in Original Scale	215.3	SD in Log Scale	1.269
95% t UCL (Assumes normality)	410.4	95% H-Stat UCL	3474

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	420.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	2
Number of Detects	2	Number of Non-Detects	5
Number of Distinct Detects	2	Number of Distinct Non-Detects	5
Minimum Detect	250	Minimum Non-Detect	24
Maximum Detect	14000	Maximum Non-Detect	29
Variance Detects	94531250	Percent Non-Detects	71.43%
Mean Detects	7125	SD Detects	9723
Median Detects	7125	CV Detects	1.365
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	7.534	SD of Logged Detects	2.846

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2053	KM Standard Error of Mean	2607
KM SD	4878	95% KM (BCA) UCL	N/A
95% KM (t) UCL	7120	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	6342	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	9875	95% KM Chebyshev UCL	13418
97.5% KM Chebyshev UCL	18336	99% KM Chebyshev UCL	27996

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.478	k star (bias corrected MLE)	N/A
Theta hat (MLE)	14897	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1.913	nu star (bias corrected)	N/A
Mean (detects)	7125		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2053	SD (KM)	4878
Variance (KM)	23795118	SE of Mean (KM)	2607
k hat (KM)	0.177	k star (KM)	0.196
nu hat (KM)	2.479	nu star (KM)	2.75
theta hat (KM)	11591	theta star (KM)	10450
80% gamma percentile (KM)	2679	90% gamma percentile (KM)	6208
95% gamma percentile (KM)	10627	99% gamma percentile (KM)	22829

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0158
Approximate Chi Square Value (2.75, α)	0.302	Adjusted Chi Square Value (2.75, β)	0.156
95% Gamma Approximate KM-UCL (use when n>=50)	18668	95% Gamma Adjusted KM-UCL (use when n<50)	36150

Table B.12.2

Summary of ProUCL Output for EU14 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 12:38:36 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260) (cont.'d)

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2036	Mean in Log Scale	-2.152
SD in Original Scale	5277	SD in Log Scale	6.718
95% t UCL (assumes normality of ROS data)	5911	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	1.241E+35		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.423	KM Geo Mean	83.32
KM SD (logged)	2.243	95% Critical H Value (KM-Log)	7.517
KM Standard Error of Mean (logged)	1.199	95% H-UCL (KM -Log)	1004603
KM SD (logged)	2.243	95% Critical H Value (KM-Log)	7.517
KM Standard Error of Mean (logged)	1.199		

DL/2 Statistics

DL/2 Normal

Mean in Original Scale	2045
SD in Original Scale	5272
95% t UCL (Assumes normality)	5918

DL/2 Log-Transformed

Mean in Log Scale	4.005
SD in Log Scale	2.677
95% H-Stat UCL	33314861

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM Chebyshev UCL	13418

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.3

Summary of ProUCL Input Data for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Ethylbenzene	D_Ethylbenzene	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS	270	0	270	0	180	1	270	0				
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	0.91	0	1.4	0	3.4	1	1.1	0	110	1	140	1
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	31	1	1200	1	35	1	39	1	330	1	260	1
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	15	0	20	0	6400	1	16	0	1700	1	2000	1
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	110	1	2600	1	50	1	410	1	59	1	39	1
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	2.6	1	2	0	5.2	1	1.6	1	200	1	260	1
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS					9.6	1			990	1	890	1
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS												
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	12	0	22	0	2200	1	13	0	850	1	940	1
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS												
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU14)	BH105-18	1/17/2018	8.5-10.5 ft BGS	0.44	0	0.36	0	6.3	1	0.37	0	150	1	180	1
on-site (EU14)	BH106-18	1/17/2018	13-15 ft BGS	30	0	34	0	36	0	17	0	6.9	0	7	0
on-site (EU14)	GP30-18	1/17/2018	10.5-11.5 ft bgs	0.29	0	0.52	1	2.7	1	0.25	0				
on-site (EU14)	GP31-18	1/19/2018	8-9 ft bgs	0.32	0	0.35	1	5.6	1	0.27	0				
on-site (EU14)	TT-8	10/6/2008	15 ft BGS	1.1	1	4.7	0	4.7	0	4.7	0	6.9	0	6.9	0
on-site (EU14)	TT-8	10/6/2008	15 ft BGS												
on-site (EU14)	TT-8	10/6/2008	4 ft BGS	20.5	1	6.25	0	6	1	29.75	1	170	1		
on-site (EU14)	TT-8	10/6/2008	4- ft BGS											123.5	1
on-site (EU14)	TT-9	10/3/2008	17 ft BGS	46	1			670	1	180	1	13	0	13	0
on-site (EU14)	TT-9	10/3/2008	17 ft BGS			7000	1								
on-site (EU14)	TT-9	10/3/2008	7 ft BGS	240	1			350	1	220	1	85	0	85	0
on-site (EU14)	TT-9	10/3/2008	7 ft BGS			15000	1								

Table B.12.3

Summary of ProUCL Input Data for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum	D_Aluminum	Antimony	D_Antimony
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS												
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	360	1	130	0	47	0	120	1	4300	1	2.8	1
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	370	1	60	1	20	0	150	1	5900	1	1.9	1
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	3000	1	71	1	510	1	1700	1	8200	1	11	1
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	61	1	29	0	11	0	18	1	6800	1	1.2	1
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	430	1	110	0	91	1	320	1	4000	1	10	1
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS	1300	1	120	1	200	1	640	1	9200	1	8.5	1
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS												
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	1200	1	76	1	230	1	720	1	7700	1	13	1
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS												
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU14)	BH105-18	1/17/2018	8.5-10.5 ft BGS	250	1	43	0	37	1	140	1	8800	1	1.8	1
on-site (EU14)	BH106-18	1/17/2018	13-15 ft BGS	6.4	0	290	0	7.2	0	3.8	0	2200	1	1.3	1
on-site (EU14)	GP30-18	1/17/2018	10.5-11.5 ft bgs												
on-site (EU14)	GP31-18	1/19/2018	8-9 ft bgs												
on-site (EU14)	TT-8	10/6/2008	15 ft BGS	6.9	0	52	0	6.9	0	6.9	0			6.2	0
on-site (EU14)	TT-8	10/6/2008	15 ft BGS									2100	1		
on-site (EU14)	TT-8	10/6/2008	4 ft BGS			190	0	24.5	0	130	1				
on-site (EU14)	TT-8	10/6/2008	4- ft BGS	184	1							7200	1	1.9	1
on-site (EU14)	TT-9	10/3/2008	17 ft BGS	13	0	95	0	13	0	13	0				
on-site (EU14)	TT-9	10/3/2008	17 ft BGS									7220	1	1.6	1
on-site (EU14)	TT-9	10/3/2008	7 ft BGS	85	0	640	0	85	0	85	0				
on-site (EU14)	TT-9	10/3/2008	7 ft BGS									5740	1	6.6	1

Table B.12.3

Summary of ProUCL Input Data for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				24	25	26	27	28	29	30	31	32	33	34	35	36	37
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS														
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	25	1	200	1	3.7	1	0.33	0	7.2	1	460	1	0.78	1
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	8.3	1	160	1	0.8	1	0.28	0	5.2	1	250	1	0.23	0
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	17	1	3100	1	11	1	0.95	1	16	1	2400	1	2.7	1
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	16	1	260	1	0.63	1	0.64	1	12	1	62	1	0.29	0
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	9	1	240	1	5.9	1	1.3	0	5.1	1	1300	1	0.21	0
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS	20	1	2800	1	9.3	1	1.2	1	17	1	1600	1	13	1
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS														
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	33	1	1200	1	8.5	1	0.55	1	13	1	1700	1	0.56	1
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS														
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS														
on-site (EU14)	BH105-18	1/17/2018	8.5-10.5 ft BGS	25	1	260	1	13	1	1.9	0	10	1	120	1	0.31	1
on-site (EU14)	BH106-18	1/17/2018	13-15 ft BGS	1.5	1	17	1	0.15	1	0.97	1	2.7	1	7.2	1	0.055	0
on-site (EU14)	GP30-18	1/17/2018	10.5-11.5 ft bgs														
on-site (EU14)	GP31-18	1/19/2018	8-9 ft bgs														
on-site (EU14)	TT-8	10/6/2008	15 ft BGS							0.7	1					0.52	0
on-site (EU14)	TT-8	10/6/2008	15 ft BGS	2.9	1	10.1	1	0.18	1			2.3	1	8.1	1		
on-site (EU14)	TT-8	10/6/2008	4 ft BGS							7.7	1					0.57	0
on-site (EU14)	TT-8	10/6/2008	4- ft BGS	9.6	1	800	1	2.3	1			5.85	1	174.5	1	0.27	1
on-site (EU14)	TT-9	10/3/2008	17 ft BGS														
on-site (EU14)	TT-9	10/3/2008	17 ft BGS	18.5	1	162	1	0.36	1	3.6	1	12.7	1	56.4	1	1.4	1
on-site (EU14)	TT-9	10/3/2008	7 ft BGS													0.64	0
on-site (EU14)	TT-9	10/3/2008	7 ft BGS	35	1	197	1	6.3	1	5.8	1	11.8	1	389	1		

Table B.12.3

Summary of ProUCL Input Data for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				38	39	40	41	42	43	44	45	46	47
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Iron	D_Iron	Lead	D_Lead	Lead - coarse fraction	D_Lead - coarse fraction	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS										
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	50000	1	340	1						
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	16000	1	510	1						
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	71000	1	4200	1	3600	1	3600	1	3600	1
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	60000	1	22	1						
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	21000	1	700	1	47000	1	28000	1	43000	1
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS	58000	1	1600	1						
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS										
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	62000	1	3300	1						
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS										
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS										
on-site (EU14)	BH105-18	1/17/2018	8.5-10.5 ft BGS	21000	1	110	1						
on-site (EU14)	BH106-18	1/17/2018	13-15 ft BGS	6400	1	11	1						
on-site (EU14)	GP30-18	1/17/2018	10.5-11.5 ft bgs										
on-site (EU14)	GP31-18	1/19/2018	8-9 ft bgs										
on-site (EU14)	TT-8	10/6/2008	15 ft BGS										
on-site (EU14)	TT-8	10/6/2008	15 ft BGS	5820	1	4.6	1						
on-site (EU14)	TT-8	10/6/2008	4 ft BGS										
on-site (EU14)	TT-8	10/6/2008	4- ft BGS	17050	1	236	1						
on-site (EU14)	TT-9	10/3/2008	17 ft BGS										
on-site (EU14)	TT-9	10/3/2008	17 ft BGS	29300	1	15	1						
on-site (EU14)	TT-9	10/3/2008	7 ft BGS										
on-site (EU14)	TT-9	10/3/2008	7 ft BGS	16800	1	1200	1						

Table B.12.3

Summary of ProUCL Input Data for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				48	49	50	51	52	53	54	55	56	57
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Manganese	D_Manganese	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS										
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	310	1	0.22	1	19	1	270	1	25	0
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	300	1	0.24	1	18	1	310	1	21	0
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	750	1	0.23	1	28	1	3000	1	24	0
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	230	1	0.49	1	46	1	58	1	29	0
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	400	1	0.11	1	13	1	470	1	420	0
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS	880	1	0.3	1	34	1	2300	1	23	0
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS										
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	630	1	0.17	1	29	1	2000	1	370	1
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS										
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS										
on-site (EU14)	BH105-18	1/17/2018	8.5-10.5 ft BGS	300	1	0.8	1	41	1	1200	1	30	0
on-site (EU14)	BH106-18	1/17/2018	13-15 ft BGS	320	1	0.11	1	8.4	1	29	1	20	0
on-site (EU14)	GP30-18	1/17/2018	10.5-11.5 ft bgs										
on-site (EU14)	GP31-18	1/19/2018	8-9 ft bgs										
on-site (EU14)	TT-8	10/6/2008	15 ft BGS	198	1	0.1	0					34	0
on-site (EU14)	TT-8	10/6/2008	15 ft BGS					8.4	1	23.2	1		
on-site (EU14)	TT-8	10/6/2008	4 ft BGS	200.5	1	0.12	0					76	0
on-site (EU14)	TT-8	10/6/2008	4- ft BGS			0.18	1	19.1	1	2255	1		
on-site (EU14)	TT-9	10/3/2008	17 ft BGS	88.1	1	0.98	1	39.2	1	40.6	1	63	0
on-site (EU14)	TT-9	10/3/2008	7 ft BGS			0.64	0					420	0
on-site (EU14)	TT-9	10/3/2008	7 ft BGS	163	1			37.3	1	89.6	1		

Table B.12.3

Summary of ProUCL Input Data for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				58	59	60	61	62	63	64	65
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Aroclor-1260 (PCB-1260)	D_Aroclor-1260 (PCB-1260)	Dieldrin	D_Dieldrin
on-site (EU14)	BH68-13	6/19/2013	0.5-2.5 ft BGS								
on-site (EU14)	SS-46	10/30/2018	0-2 ft BGS	32	0	54	1	29	0	1.5	0
on-site (EU14)	SS-47	11/2/2018	0-2 ft BGS	27	0	330	1	24	0	6.1	0
on-site (EU14)	SS-48	10/29/2018	0.25-2.25 ft BGS	31	0	390	1	28	0	7	0
on-site (EU14)	SS-49	10/29/2018	0-2 ft BGS	37	0	35	0	250	1	17	0
on-site (EU14)	SS-50	10/29/2018	0.17-2.17 ft BGS	530	0	510	0	14000	1	61	0
on-site (EU14)	SS-51	10/29/2018	0.25-2.25 ft BGS	29	0	99	1	27	0	6.7	0
on-site (EU14)	SS-52	10/29/2018	0-2 ft BGS								
on-site (EU14)	SS-53	10/29/2018	0-2 ft BGS	29	0	620	1	26	0	6.5	0
on-site (EU14)	SS-169-AS	10/30/2018	0-0.5 ft BGS								
on-site (EU14)	SS-170-AS	10/29/2018	0-0.5 ft BGS								
on-site (EU14)	BH105-18	1/17/2018	8.5-10.5 ft BGS	38	0	37	0	35	0	1.4	0
on-site (EU14)	BH106-18	1/17/2018	13-15 ft BGS	26	0	25	0	24	0	0.97	0
on-site (EU14)	GP30-18	1/17/2018	10.5-11.5 ft bgs								
on-site (EU14)	GP31-18	1/19/2018	8-9 ft bgs								
on-site (EU14)	TT-8	10/6/2008	15 ft BGS	34	0	34	0	34	0	8.8	0
on-site (EU14)	TT-8	10/6/2008	15 ft BGS								
on-site (EU14)	TT-8	10/6/2008	4 ft BGS	430	1	76	0	440	1	12	1
on-site (EU14)	TT-8	10/6/2008	4- ft BGS								
on-site (EU14)	TT-9	10/3/2008	17 ft BGS	63	0	200	1	63	0	65	0
on-site (EU14)	TT-9	10/3/2008	17 ft BGS								
on-site (EU14)	TT-9	10/3/2008	7 ft BGS	420	0	3700	1	420	0	270	1
on-site (EU14)	TT-9	10/3/2008	7 ft BGS								

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	7
Number of Detects	7	Number of Non-Detects	8
Number of Distinct Detects	7	Number of Distinct Non-Detects	8
Minimum Detect	1.1	Minimum Non-Detect	0.29
Maximum Detect	240	Maximum Non-Detect	270
Variance Detects	7354	Percent Non-Detects	53.33%
Mean Detects	64.46	SD Detects	85.75
Median Detects	31	CV Detects	1.33
Skewness Detects	1.807	Kurtosis Detects	3.141
Mean of Logged Detects	3.074	SD of Logged Detects	1.936

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.776	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	32.64	KM Standard Error of Mean	18.64
KM SD	64.55	95% KM (BCA) UCL	64.97
95% KM (t) UCL	65.48	95% KM (Percentile Bootstrap) UCL	62.24
95% KM (z) UCL	63.31	95% KM Bootstrap t UCL	132.2
90% KM Chebyshev UCL	88.57	95% KM Chebyshev UCL	113.9
97.5% KM Chebyshev UCL	149.1	99% KM Chebyshev UCL	218.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.192	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.326	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.57	k star (bias corrected MLE)	0.421
Theta hat (MLE)	113.1	Theta star (bias corrected MLE)	153.1
nu hat (MLE)	7.979	nu star (bias corrected)	5.893
Mean (detects)	64.46		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	30.09
Maximum	240	Median	0.01
SD	65.26	CV	2.169
k hat (MLE)	0.17	k star (bias corrected MLE)	0.181
Theta hat (MLE)	176.5	Theta star (bias corrected MLE)	166.4
nu hat (MLE)	5.112	nu star (bias corrected)	5.423
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (5.42, α)	1.353	Adjusted Chi Square Value (5.42, β)	1.121
95% Gamma Approximate UCL (use when n>=50)	120.6	95% Gamma Adjusted UCL (use when n<50)	145.6

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	32.64	SD (KM)	64.55
Variance (KM)	4167	SE of Mean (KM)	18.64
k hat (KM)	0.256	k star (KM)	0.249
nu hat (KM)	7.67	nu star (KM)	7.47
theta hat (KM)	127.7	theta star (KM)	131.1
80% gamma percentile (KM)	47.34	90% gamma percentile (KM)	98
95% gamma percentile (KM)	158.2	99% gamma percentile (KM)	318.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.47, α)	2.432	Adjusted Chi Square Value (7.47, β)	2.093
95% Gamma Approximate KM-UCL (use when n>=50)	100.3	95% Gamma Adjusted KM-UCL (use when n<50)	116.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	30.34	Mean in Log Scale	0.806
SD in Original Scale	65.14	SD in Log Scale	2.625
95% t UCL (assumes normality of ROS data)	59.97	95% Percentile Bootstrap UCL	60.18
95% BCA Bootstrap UCL	71.79	95% Bootstrap t UCL	146.6
95% H-UCL (Log ROS)	4127		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.073	KM Geo Mean	2.924
KM SD (logged)	2.436	95% Critical H Value (KM-Log)	5.427
KM Standard Error of Mean (logged)	0.723	95% H-UCL (KM -Log)	1942
KM SD (logged)	2.436	95% Critical H Value (KM-Log)	5.427
KM Standard Error of Mean (logged)	0.723		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	41.05	Mean in Log Scale	1.791
SD in Original Scale	68.91	SD in Log Scale	2.524
95% t UCL (Assumes normality)	72.38	95% H-Stat UCL	6346

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	65.48

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	8
Number of Detects	6	Number of Non-Detects	9
Number of Distinct Detects	6	Number of Distinct Non-Detects	9
Minimum Detect	0.35	Minimum Non-Detect	0.36
Maximum Detect	15000	Maximum Non-Detect	270
Variance Detects	34250504	Percent Non-Detects	60%
Mean Detects	4300	SD Detects	5852
Median Detects	1900	CV Detects	1.361
Skewness Detects	1.573	Kurtosis Detects	2.071
Mean of Logged Detects	5.287	SD of Logged Detects	4.833

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.804	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1720	KM Standard Error of Mean	1126
KM SD	3982	95% KM (BCA) UCL	3574
95% KM (t) UCL	3704	95% KM (Percentile Bootstrap) UCL	3654
95% KM (z) UCL	3573	95% KM Bootstrap t UCL	9142
90% KM Chebyshev UCL	5099	95% KM Chebyshev UCL	6629
97.5% KM Chebyshev UCL	8753	99% KM Chebyshev UCL	12926

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.483	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.79	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.241	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.362	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.233	k star (bias corrected MLE)	0.228
Theta hat (MLE)	18439	Theta star (bias corrected MLE)	18884
nu hat (MLE)	2.799	nu star (bias corrected)	2.733
Mean (detects)	4300		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1720
Maximum	15000	Median	0.01
SD	4122	CV	2.396
k hat (MLE)	0.1	k star (bias corrected MLE)	0.125
Theta hat (MLE)	17158	Theta star (bias corrected MLE)	13800
nu hat (MLE)	3.007	nu star (bias corrected)	3.739
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (3.74, α)	0.621	Adjusted Chi Square Value (3.74, β)	0.488
95% Gamma Approximate UCL (use when n>=50)	10349	95% Gamma Adjusted UCL (use when n<50)	13173

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1720	SD (KM)	3982
Variance (KM)	15853907	SE of Mean (KM)	1126
k hat (KM)	0.187	k star (KM)	0.194
nu hat (KM)	5.6	nu star (KM)	5.813
theta hat (KM)	9216	theta star (KM)	8878
80% gamma percentile (KM)	2229	90% gamma percentile (KM)	5201
95% gamma percentile (KM)	8936	99% gamma percentile (KM)	19274

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.81, α)	1.545	Adjusted Chi Square Value (5.81, β)	1.292
95% Gamma Approximate KM-UCL (use when n>=50)	6472	95% Gamma Adjusted KM-UCL (use when n<50)	7741

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.788	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1720	Mean in Log Scale	1.748
SD in Original Scale	4121	SD in Log Scale	4.185
95% t UCL (assumes normality of ROS data)	3595	95% Percentile Bootstrap UCL	3547
95% BCA Bootstrap UCL	4640	95% Bootstrap t UCL	11016
95% H-UCL (Log ROS)	8.772E+8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.555	KM Geo Mean	4.736
KM SD (logged)	4.134	95% Critical H Value (KM-Log)	8.91
KM Standard Error of Mean (logged)	1.172	95% H-UCL (KM -Log)	4.585E+8
KM SD (logged)	4.134	95% Critical H Value (KM-Log)	8.91
KM Standard Error of Mean (logged)	1.172		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1732	Mean in Log Scale	2.939
SD in Original Scale	4116	SD in Log Scale	3.81
95% t UCL (Assumes normality)	3604	95% H-Stat UCL	1.153E+8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	3704

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	16	Number of Distinct Observations	16
		Number of Missing Observations	6
Number of Detects	14	Number of Non-Detects	2
Number of Distinct Detects	14	Number of Distinct Non-Detects	2
Minimum Detect	2.7	Minimum Non-Detect	4.7
Maximum Detect	6400	Maximum Non-Detect	36
Variance Detects	3028720	Percent Non-Detects	12.5%
Mean Detects	708.8	SD Detects	1740
Median Detects	22.3	CV Detects	2.455
Skewness Detects	3.14	Kurtosis Detects	10.25
Mean of Logged Detects	3.783	SD of Logged Detects	2.588

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.478	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.367	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	621	KM Standard Error of Mean	411.4
KM SD	1586	95% KM (BCA) UCL	1429
95% KM (t) UCL	1342	95% KM (Percentile Bootstrap) UCL	1384
95% KM (z) UCL	1298	95% KM Bootstrap t UCL	5584
90% KM Chebyshev UCL	1855	95% KM Chebyshev UCL	2414
97.5% KM Chebyshev UCL	3190	99% KM Chebyshev UCL	4715

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.229	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.854	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.248	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.255	k star (bias corrected MLE)	0.248
Theta hat (MLE)	2783	Theta star (bias corrected MLE)	2861
nu hat (MLE)	7.132	nu star (bias corrected)	6.937
Mean (detects)	708.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	620.2
Maximum	6400	Median	7.95
SD	1638	CV	2.641
k hat (MLE)	0.199	k star (bias corrected MLE)	0.204
Theta hat (MLE)	3113	Theta star (bias corrected MLE)	3047
nu hat (MLE)	6.377	nu star (bias corrected)	6.514
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (6.51, α)	1.908	Adjusted Chi Square Value (6.51, β)	1.638
95% Gamma Approximate UCL (use when n>=50)	2118	95% Gamma Adjusted UCL (use when n<50)	2466

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	621	SD (KM)	1586
Variance (KM)	2514903	SE of Mean (KM)	411.4
k hat (KM)	0.153	k star (KM)	0.166
nu hat (KM)	4.906	nu star (KM)	5.32
theta hat (KM)	4050	theta star (KM)	3735
80% gamma percentile (KM)	730.9	90% gamma percentile (KM)	1863
95% gamma percentile (KM)	3345	99% gamma percentile (KM)	7562

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.32, α)	1.303	Adjusted Chi Square Value (5.32, β)	1.093
95% Gamma Approximate KM-UCL (use when n>=50)	2536	95% Gamma Adjusted KM-UCL (use when n<50)	3023

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	620.8	Mean in Log Scale	3.437
SD in Original Scale	1638	SD in Log Scale	2.618
95% t UCL (assumes normality of ROS data)	1339	95% Percentile Bootstrap UCL	1366
95% BCA Bootstrap UCL	1820	95% Bootstrap t UCL	5585
95% H-UCL (Log ROS)	44040		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.492	KM Geo Mean	32.85
KM SD (logged)	2.467	95% Critical H Value (KM-Log)	5.371
KM Standard Error of Mean (logged)	0.642	95% H-UCL (KM -Log)	21092
KM SD (logged)	2.467	95% Critical H Value (KM-Log)	5.371
KM Standard Error of Mean (logged)	0.642		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	621.5	Mean in Log Scale	3.545
SD in Original Scale	1638	SD in Log Scale	2.524
95% t UCL (Assumes normality)	1339	95% H-Stat UCL	29798

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	3023

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	7
Number of Detects	6	Number of Non-Detects	9
Number of Distinct Detects	6	Number of Distinct Non-Detects	9
Minimum Detect	1.6	Minimum Non-Detect	0.25
Maximum Detect	410	Maximum Non-Detect	270
Variance Detects	24428	Percent Non-Detects	60%
Mean Detects	146.7	SD Detects	156.3
Median Detects	109.5	CV Detects	1.065
Skewness Detects	1.004	Kurtosis Detects	0.319
Mean of Logged Detects	4.022	SD of Logged Detects	2.018

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.255	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	61.32	KM Standard Error of Mean	33.21
KM SD	115.8	95% KM (BCA) UCL	117.1
95% KM (t) UCL	119.8	95% KM (Percentile Bootstrap) UCL	114.3
95% KM (z) UCL	115.9	95% KM Bootstrap t UCL	151.9
90% KM Chebyshev UCL	160.9	95% KM Chebyshev UCL	206.1
97.5% KM Chebyshev UCL	268.7	99% KM Chebyshev UCL	391.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.262	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.221	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.346	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.634	k star (bias corrected MLE)	0.428
Theta hat (MLE)	231.5	Theta star (bias corrected MLE)	342.8
nu hat (MLE)	7.606	nu star (bias corrected)	5.136
Mean (detects)	146.7		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	58.7
Maximum	410	Median	0.01
SD	119.4	CV	2.034
k hat (MLE)	0.147	k star (bias corrected MLE)	0.162
Theta hat (MLE)	398.2	Theta star (bias corrected MLE)	361.5
nu hat (MLE)	4.422	nu star (bias corrected)	4.871
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (4.87, α)	1.093	Adjusted Chi Square Value (4.87, β)	0.892
95% Gamma Approximate UCL (use when n>=50)	261.6	95% Gamma Adjusted UCL (use when n<50)	320.4

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	61.32	SD (KM)	115.8
Variance (KM)	13420	SE of Mean (KM)	33.21
k hat (KM)	0.28	k star (KM)	0.269
nu hat (KM)	8.406	nu star (KM)	8.058
theta hat (KM)	218.8	theta star (KM)	228.3
80% gamma percentile (KM)	91.21	90% gamma percentile (KM)	183
95% gamma percentile (KM)	290.4	99% gamma percentile (KM)	573.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.06, α)	2.769	Adjusted Chi Square Value (8.06, β)	2.401
95% Gamma Approximate KM-UCL (use when n>=50)	178.5	95% Gamma Adjusted KM-UCL (use when n<50)	205.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	59.2	Mean in Log Scale	1.398
SD in Original Scale	119.2	SD in Log Scale	2.561
95% t UCL (assumes normality of ROS data)	113.4	95% Percentile Bootstrap UCL	113
95% BCA Bootstrap UCL	135.7	95% Bootstrap t UCL	170.8
95% H-UCL (Log ROS)	5253		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.012	KM Geo Mean	2.751
KM SD (logged)	2.868	95% Critical H Value (KM-Log)	6.301
KM Standard Error of Mean (logged)	0.85	95% H-UCL (KM -Log)	21045
KM SD (logged)	2.868	95% Critical H Value (KM-Log)	6.301
KM Standard Error of Mean (logged)	0.85		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	69.45	Mean in Log Scale	1.974
SD in Original Scale	118.7	SD in Log Scale	2.773
95% t UCL (Assumes normality)	123.4	95% H-Stat UCL	31182

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	119.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	9
Number of Detects	9	Number of Non-Detects	4
Number of Distinct Detects	9	Number of Distinct Non-Detects	3
Minimum Detect	59	Minimum Non-Detect	6.9
Maximum Detect	1700	Maximum Non-Detect	85
Variance Detects	312387	Percent Non-Detects	30.77%
Mean Detects	506.6	SD Detects	558.9
Median Detects	200	CV Detects	1.103
Skewness Detects	1.458	Kurtosis Detects	1.47
Mean of Logged Detects	5.678	SD of Logged Detects	1.126

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.79	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.291	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	353.8	KM Standard Error of Mean	145.6
KM SD	494.7	95% KM (BCA) UCL	610.8
95% KM (t) UCL	613.2	95% KM (Percentile Bootstrap) UCL	587.7
95% KM (z) UCL	593.2	95% KM Bootstrap t UCL	789.2
90% KM Chebyshev UCL	790.5	95% KM Chebyshev UCL	988.3
97.5% KM Chebyshev UCL	1263	99% KM Chebyshev UCL	1802

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.47	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.239	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.287	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.045	k star (bias corrected MLE)	0.771
Theta hat (MLE)	484.7	Theta star (bias corrected MLE)	657.2
nu hat (MLE)	18.81	nu star (bias corrected)	13.87
Mean (detects)	506.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	350.7
Maximum	1700	Median	150
SD	517.2	CV	1.475
k hat (MLE)	0.217	k star (bias corrected MLE)	0.218
Theta hat (MLE)	1615	Theta star (bias corrected MLE)	1606
nu hat (MLE)	5.645	nu star (bias corrected)	5.676
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (5.68, α)	1.477	Adjusted Chi Square Value (5.68, β)	1.195
95% Gamma Approximate UCL (use when n>=50)	1348	95% Gamma Adjusted UCL (use when n<50)	1666

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	353.8	SD (KM)	494.7
Variance (KM)	244777	SE of Mean (KM)	145.6
k hat (KM)	0.511	k star (KM)	0.445
nu hat (KM)	13.3	nu star (KM)	11.56
theta hat (KM)	691.8	theta star (KM)	795.6
80% gamma percentile (KM)	577	90% gamma percentile (KM)	980
95% gamma percentile (KM)	1417	99% gamma percentile (KM)	2503

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.56, α)	4.94	Adjusted Chi Square Value (11.56, β)	4.339
95% Gamma Approximate KM-UCL (use when n>=50)	828.1	95% Gamma Adjusted KM-UCL (use when n<50)	942.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	356.9	Mean in Log Scale	4.842
SD in Original Scale	512.7	SD in Log Scale	1.608
95% t UCL (assumes normality of ROS data)	610.4	95% Percentile Bootstrap UCL	617.5
95% BCA Bootstrap UCL	671.2	95% Bootstrap t UCL	802.8
95% H-UCL (Log ROS)	2929		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.567	KM Geo Mean	96.22
KM SD (logged)	1.909	95% Critical H Value (KM-Log)	4.579
KM Standard Error of Mean (logged)	0.568	95% H-UCL (KM -Log)	7412
KM SD (logged)	1.909	95% Critical H Value (KM-Log)	4.579
KM Standard Error of Mean (logged)	0.568		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	355	Mean in Log Scale	4.554
SD in Original Scale	514.1	SD in Log Scale	2.068
95% t UCL (Assumes normality)	609.1	95% H-Stat UCL	15575

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	789.2	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	942.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	9
Number of Detects	9	Number of Non-Detects	4
Number of Distinct Detects	8	Number of Distinct Non-Detects	4
Minimum Detect	39	Minimum Non-Detect	6.9
Maximum Detect	2000	Maximum Non-Detect	85
Variance Detects	410611	Percent Non-Detects	30.77%
Mean Detects	536.9	SD Detects	640.8
Median Detects	260	CV Detects	1.193
Skewness Detects	1.769	Kurtosis Detects	3.002
Mean of Logged Detects	5.664	SD of Logged Detects	1.22

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.755	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.334	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	374.5	KM Standard Error of Mean	164.3
KM SD	558.7	95% KM (BCA) UCL	646.3
95% KM (t) UCL	667.4	95% KM (Percentile Bootstrap) UCL	659.8
95% KM (z) UCL	644.8	95% KM Bootstrap t UCL	906.9
90% KM Chebyshev UCL	867.5	95% KM Chebyshev UCL	1091
97.5% KM Chebyshev UCL	1401	99% KM Chebyshev UCL	2010

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.451	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.27	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.288	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.935	k star (bias corrected MLE)	0.698
Theta hat (MLE)	574.1	Theta star (bias corrected MLE)	769.7
nu hat (MLE)	16.83	nu star (bias corrected)	12.56
Mean (detects)	536.9		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	371.7
Maximum	2000	Median	140
SD	583.3	CV	1.569
k hat (MLE)	0.213	k star (bias corrected MLE)	0.215
Theta hat (MLE)	1742	Theta star (bias corrected MLE)	1726
nu hat (MLE)	5.548	nu star (bias corrected)	5.601
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (5.60, α)	1.439	Adjusted Chi Square Value (5.60, β)	1.162
95% Gamma Approximate UCL (use when n>=50)	1446	95% Gamma Adjusted UCL (use when n<50)	1791

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	374.5	SD (KM)	558.7
Variance (KM)	312097	SE of Mean (KM)	164.3
k hat (KM)	0.449	k star (KM)	0.397
nu hat (KM)	11.68	nu star (KM)	10.32
theta hat (KM)	833.4	theta star (KM)	943.5
80% gamma percentile (KM)	603.8	90% gamma percentile (KM)	1059
95% gamma percentile (KM)	1560	99% gamma percentile (KM)	2821

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.32, α)	4.142	Adjusted Chi Square Value (10.32, β)	3.602
95% Gamma Approximate KM-UCL (use when n>=50)	932.9	95% Gamma Adjusted KM-UCL (use when n<50)	1073

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	376.7	Mean in Log Scale	4.77
SD in Original Scale	580	SD in Log Scale	1.717
95% t UCL (assumes normality of ROS data)	663.4	95% Percentile Bootstrap UCL	634
95% BCA Bootstrap UCL	742	95% Bootstrap t UCL	904.5
95% H-UCL (Log ROS)	4067		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.549	KM Geo Mean	94.51
KM SD (logged)	1.941	95% Critical H Value (KM-Log)	4.657
KM Standard Error of Mean (logged)	0.575	95% H-UCL (KM -Log)	8448
KM SD (logged)	1.941	95% Critical H Value (KM-Log)	4.657
KM Standard Error of Mean (logged)	0.575		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	376	Mean in Log Scale	4.545
SD in Original Scale	580.5	SD in Log Scale	2.096
95% t UCL (Assumes normality)	663	95% H-Stat UCL	17646

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	906.9	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	1073

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	9
Number of Detects	9	Number of Non-Detects	4
Number of Distinct Detects	9	Number of Distinct Non-Detects	4
Minimum Detect	61	Minimum Non-Detect	6.4
Maximum Detect	3000	Maximum Non-Detect	85
Variance Detects	874157	Percent Non-Detects	30.77%
Mean Detects	795	SD Detects	935
Median Detects	370	CV Detects	1.176
Skewness Detects	1.951	Kurtosis Detects	3.959
Mean of Logged Detects	6.109	SD of Logged Detects	1.168

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.748	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	553.4	KM Standard Error of Mean	240.7
KM SD	818.1	95% KM (BCA) UCL	968.4
95% KM (t) UCL	982.4	95% KM (Percentile Bootstrap) UCL	983.1
95% KM (z) UCL	949.3	95% KM Bootstrap t UCL	1545
90% KM Chebyshev UCL	1275	95% KM Chebyshev UCL	1603
97.5% KM Chebyshev UCL	2056	99% KM Chebyshev UCL	2948

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.383	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.251	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.287	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.012	k star (bias corrected MLE)	0.749
Theta hat (MLE)	785.8	Theta star (bias corrected MLE)	1062
nu hat (MLE)	18.21	nu star (bias corrected)	13.47
Mean (detects)	795		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	550.4
Maximum	3000	Median	250
SD	853.6	CV	1.551
k hat (MLE)	0.209	k star (bias corrected MLE)	0.212
Theta hat (MLE)	2634	Theta star (bias corrected MLE)	2596
nu hat (MLE)	5.432	nu star (bias corrected)	5.512
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (5.51, α)	1.396	Adjusted Chi Square Value (5.51, β)	1.124
95% Gamma Approximate UCL (use when n>=50)	2174	95% Gamma Adjusted UCL (use when n<50)	2698

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	553.4	SD (KM)	818.1
Variance (KM)	669326	SE of Mean (KM)	240.7
k hat (KM)	0.458	k star (KM)	0.403
nu hat (KM)	11.9	nu star (KM)	10.48
theta hat (KM)	1209	theta star (KM)	1372
80% gamma percentile (KM)	894	90% gamma percentile (KM)	1561
95% gamma percentile (KM)	2293	99% gamma percentile (KM)	4132

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.48, α)	4.247	Adjusted Chi Square Value (10.48, β)	3.698
95% Gamma Approximate KM-UCL (use when n>=50)	1366	95% Gamma Adjusted KM-UCL (use when n<50)	1569

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	559.1	Mean in Log Scale	5.253
SD in Original Scale	847.6	SD in Log Scale	1.644
95% t UCL (assumes normality of ROS data)	978.1	95% Percentile Bootstrap UCL	979.8
95% BCA Bootstrap UCL	1139	95% Bootstrap t UCL	1401
95% H-UCL (Log ROS)	5032		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.844	KM Geo Mean	126.9
KM SD (logged)	2.129	95% Critical H Value (KM-Log)	5.09
KM Standard Error of Mean (logged)	0.633	95% H-UCL (KM -Log)	27939
KM SD (logged)	2.129	95% Critical H Value (KM-Log)	5.09
KM Standard Error of Mean (logged)	0.633		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	554.7	Mean in Log Scale	4.846
SD in Original Scale	850.7	SD in Log Scale	2.271
95% t UCL (Assumes normality)	975.2	95% H-Stat UCL	57642

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	1545	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	1569

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	9
Number of Detects	4	Number of Non-Detects	9
Number of Distinct Detects	4	Number of Distinct Non-Detects	9
Minimum Detect	60	Minimum Non-Detect	29
Maximum Detect	120	Maximum Non-Detect	640
Variance Detects	694.9	Percent Non-Detects	69.23%
Mean Detects	81.75	SD Detects	26.36
Median Detects	73.5	CV Detects	0.322
Skewness Detects	1.61	Kurtosis Detects	2.92
Mean of Logged Detects	4.369	SD of Logged Detects	0.296

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	56.89	KM Standard Error of Mean	12.16
KM SD	29.55	95% KM (BCA) UCL	N/A
95% KM (t) UCL	78.57	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	76.89	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	93.37	95% KM Chebyshev UCL	109.9
97.5% KM Chebyshev UCL	132.8	99% KM Chebyshev UCL	177.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.413	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.324	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	14.51	k star (bias corrected MLE)	3.794
Theta hat (MLE)	5.634	Theta star (bias corrected MLE)	21.55
nu hat (MLE)	116.1	nu star (bias corrected)	30.35
Mean (detects)	81.75		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	27.64	Mean	55.25
Maximum	120	Median	53.02
SD	24.67	CV	0.446
k hat (MLE)	6.12	k star (bias corrected MLE)	4.759
Theta hat (MLE)	9.028	Theta star (bias corrected MLE)	11.61
nu hat (MLE)	159.1	nu star (bias corrected)	123.7
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (123.73, α)	99.04	Adjusted Chi Square Value (123.73, β)	95.89
95% Gamma Approximate UCL (use when n>=50)	69.02	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	56.89	SD (KM)	29.55
Variance (KM)	873.3	SE of Mean (KM)	12.16
k hat (KM)	3.706	k star (KM)	2.902
nu hat (KM)	96.35	nu star (KM)	75.45
theta hat (KM)	15.35	theta star (KM)	19.6
80% gamma percentile (KM)	81.47	90% gamma percentile (KM)	101.7
95% gamma percentile (KM)	120.5	99% gamma percentile (KM)	161.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (75.45, α)	56.45	Adjusted Chi Square Value (75.45, β)	54.11
95% Gamma Approximate KM-UCL (use when n>=50)	76.04	95% Gamma Adjusted KM-UCL (use when n<50)	79.33

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	59.53	Mean in Log Scale	4.039
SD in Original Scale	21.3	SD in Log Scale	0.306
95% t UCL (assumes normality of ROS data)	70.06	95% Percentile Bootstrap UCL	68.91
95% BCA Bootstrap UCL	72.39	95% Bootstrap t UCL	77.45
95% H-UCL (Log ROS)	70.45		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.908	KM Geo Mean	49.81
KM SD (logged)	0.516	95% Critical H Value (KM-Log)	2.131
KM Standard Error of Mean (logged)	0.219	95% H-UCL (KM -Log)	78.14
KM SD (logged)	0.516	95% Critical H Value (KM-Log)	2.131
KM Standard Error of Mean (logged)	0.219		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	85.88	Mean in Log Scale	4.14
SD in Original Scale	79.7	SD in Log Scale	0.825
95% t UCL (Assumes normality)	125.3	95% H-Stat UCL	162.3

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	78.57

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	9
Number of Detects	5	Number of Non-Detects	8
Number of Distinct Detects	5	Number of Distinct Non-Detects	8
Minimum Detect	37	Minimum Non-Detect	6.9
Maximum Detect	510	Maximum Non-Detect	85
Variance Detects	33631	Percent Non-Detects	61.54%
Mean Detects	213.6	SD Detects	183.4
Median Detects	200	CV Detects	0.859
Skewness Detects	1.263	Kurtosis Detects	1.854
Mean of Logged Detects	5.019	SD of Logged Detects	0.996

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	87.06	KM Standard Error of Mean	44.29
KM SD	142.7	95% KM (BCA) UCL	168
95% KM (t) UCL	166	95% KM (Percentile Bootstrap) UCL	160.1
95% KM (z) UCL	159.9	95% KM Bootstrap t UCL	179.9
90% KM Chebyshev UCL	219.9	95% KM Chebyshev UCL	280.1
97.5% KM Chebyshev UCL	363.6	99% KM Chebyshev UCL	527.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.206	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.686	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.174	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.361	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.593	k star (bias corrected MLE)	0.771
Theta hat (MLE)	134.1	Theta star (bias corrected MLE)	277.2
nu hat (MLE)	15.93	nu star (bias corrected)	7.705
Mean (detects)	213.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	82.16
Maximum	510	Median	0.01
SD	151.4	CV	1.842
k hat (MLE)	0.145	k star (bias corrected MLE)	0.163
Theta hat (MLE)	565.3	Theta star (bias corrected MLE)	503.8
nu hat (MLE)	3.779	nu star (bias corrected)	4.24
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (4.24, α)	0.819	Adjusted Chi Square Value (4.24, β)	0.632
95% Gamma Approximate UCL (use when n>=50)	425.5	95% Gamma Adjusted UCL (use when n<50)	551.4

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	87.06	SD (KM)	142.7
Variance (KM)	20375	SE of Mean (KM)	44.29
k hat (KM)	0.372	k star (KM)	0.337
nu hat (KM)	9.672	nu star (KM)	8.774
theta hat (KM)	234	theta star (KM)	258
80% gamma percentile (KM)	137	90% gamma percentile (KM)	252.8
95% gamma percentile (KM)	383.2	99% gamma percentile (KM)	717.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.77, α)	3.191	Adjusted Chi Square Value (8.77, β)	2.73
95% Gamma Approximate KM-UCL (use when n>=50)	239.4	95% Gamma Adjusted KM-UCL (use when n<50)	279.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	86.36	Mean in Log Scale	3.108
SD in Original Scale	148.9	SD in Log Scale	1.677
95% t UCL (assumes normality of ROS data)	160	95% Percentile Bootstrap UCL	157.3
95% BCA Bootstrap UCL	193.9	95% Bootstrap t UCL	236.7
95% H-UCL (Log ROS)	665.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.156	KM Geo Mean	23.47
KM SD (logged)	1.592	95% Critical H Value (KM-Log)	3.952
KM Standard Error of Mean (logged)	0.5	95% H-UCL (KM -Log)	512.2
KM SD (logged)	1.592	95% Critical H Value (KM-Log)	3.952
KM Standard Error of Mean (logged)	0.5		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	90.41	Mean in Log Scale	3.3
SD in Original Scale	146.9	SD in Log Scale	1.671
95% t UCL (Assumes normality)	163	95% H-Stat UCL	788

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	166

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	9
Number of Detects	9	Number of Non-Detects	4
Number of Distinct Detects	9	Number of Distinct Non-Detects	4
Minimum Detect	18	Minimum Non-Detect	3.8
Maximum Detect	1700	Maximum Non-Detect	85
Variance Detects	283879	Percent Non-Detects	30.77%
Mean Detects	437.6	SD Detects	532.8
Median Detects	150	CV Detects	1.218
Skewness Detects	1.972	Kurtosis Detects	4.114
Mean of Logged Detects	5.416	SD of Logged Detects	1.329

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.747	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.261	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	304.4	KM Standard Error of Mean	136.3
KM SD	463.3	95% KM (BCA) UCL	559
95% KM (t) UCL	547.3	95% KM (Percentile Bootstrap) UCL	528.1
95% KM (z) UCL	528.5	95% KM Bootstrap t UCL	790.1
90% KM Chebyshev UCL	713.2	95% KM Chebyshev UCL	898.4
97.5% KM Chebyshev UCL	1155	99% KM Chebyshev UCL	1660

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.387	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.288	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.881	k star (bias corrected MLE)	0.662
Theta hat (MLE)	496.5	Theta star (bias corrected MLE)	661.3
nu hat (MLE)	15.86	nu star (bias corrected)	11.91
Mean (detects)	437.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	302.9
Maximum	1700	Median	130
SD	483.1	CV	1.595
k hat (MLE)	0.215	k star (bias corrected MLE)	0.217
Theta hat (MLE)	1408	Theta star (bias corrected MLE)	1397
nu hat (MLE)	5.595	nu star (bias corrected)	5.637
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (5.64, α)	1.457	Adjusted Chi Square Value (5.64, β)	1.178
95% Gamma Approximate UCL (use when n>=50)	1172	95% Gamma Adjusted UCL (use when n<50)	1450

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	304.4	SD (KM)	463.3
Variance (KM)	214612	SE of Mean (KM)	136.3
k hat (KM)	0.432	k star (KM)	0.383
nu hat (KM)	11.22	nu star (KM)	9.966
theta hat (KM)	705.1	theta star (KM)	794
80% gamma percentile (KM)	488.6	90% gamma percentile (KM)	866.1
95% gamma percentile (KM)	1283	99% gamma percentile (KM)	2337

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.97, α)	3.921	Adjusted Chi Square Value (9.97, β)	3.398
95% Gamma Approximate KM-UCL (use when n>=50)	773.7	95% Gamma Adjusted KM-UCL (use when n<50)	892.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.207	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	306.1	Mean in Log Scale	4.462
SD in Original Scale	481	SD in Log Scale	1.846
95% t UCL (assumes normality of ROS data)	543.9	95% Percentile Bootstrap UCL	545.9
95% BCA Bootstrap UCL	656.2	95% Bootstrap t UCL	851.7
95% H-UCL (Log ROS)	5048		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.19	KM Geo Mean	66.04
KM SD (logged)	2.124	95% Critical H Value (KM-Log)	5.08
KM Standard Error of Mean (logged)	0.628	95% H-UCL (KM -Log)	14188
KM SD (logged)	2.124	95% Critical H Value (KM-Log)	5.08
KM Standard Error of Mean (logged)	0.628		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	307.1	Mean in Log Scale	4.327
SD in Original Scale	480.4	SD in Log Scale	2.127
95% t UCL (Assumes normality)	544.6	95% H-Stat UCL	16497

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	547.3

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	10
Minimum	2100	Mean	6105
Maximum	9200	Median	6800
SD	2343	Std. Error of Mean	649.7
Coefficient of Variation	0.384	Skewness	-0.563

Normal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.155	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7263	95% Adjusted-CLT UCL (Chen-1995)	7065
		95% Modified-t UCL (Johnson-1978)	7246

Gamma GOF Test

A-D Test Statistic	0.652	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.237	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.521	k star (bias corrected MLE)	4.298
Theta hat (MLE)	1106	Theta star (bias corrected MLE)	1420
nu hat (MLE)	143.6	nu star (bias corrected)	111.8
MLE Mean (bias corrected)	6105	MLE Sd (bias corrected)	2944
		Approximate Chi Square Value (0.05)	88.35
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	85.39

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7722	95% Adjusted Gamma UCL (use when n<50)	7989

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.218	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.65	Mean of logged Data	8.624
Maximum of Logged Data	9.127	SD of logged Data	0.49

Assuming Lognormal Distribution

95% H-UCL	8442	90% Chebyshev (MVUE) UCL	8803
95% Chebyshev (MVUE) UCL	9979	97.5% Chebyshev (MVUE) UCL	11611
99% Chebyshev (MVUE) UCL	14817		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7173	95% Jackknife UCL	7263
95% Standard Bootstrap UCL	7134	95% Bootstrap-t UCL	7176
95% Hall's Bootstrap UCL	7045	95% Percentile Bootstrap UCL	7095
95% BCA Bootstrap UCL	7037		
90% Chebyshev(Mean, Sd) UCL	8054	95% Chebyshev(Mean, Sd) UCL	8937
97.5% Chebyshev(Mean, Sd) UCL	10162	99% Chebyshev(Mean, Sd) UCL	12569

Suggested UCL to Use

95% Student's-t UCL	7263

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	10
Number of Detects	12	Number of Non-Detects	1
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	1.2	Minimum Non-Detect	6.2
Maximum Detect	13	Maximum Non-Detect	6.2
Variance Detects	19.42	Percent Non-Detects	7.692%
Mean Detects	5.133	SD Detects	4.406
Median Detects	2.35	CV Detects	0.858
Skewness Detects	0.723	Kurtosis Detects	-1.237
Mean of Logged Detects	1.259	SD of Logged Detects	0.92

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.813	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.876	KM Standard Error of Mean	1.204
KM SD	4.153	95% KM (BCA) UCL	6.962
95% KM (t) UCL	7.021	95% KM (Percentile Bootstrap) UCL	6.908
95% KM (z) UCL	6.856	95% KM Bootstrap t UCL	7.59
90% KM Chebyshev UCL	8.487	95% KM Chebyshev UCL	10.12
97.5% KM Chebyshev UCL	12.39	99% KM Chebyshev UCL	16.85

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.908	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.746	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.271	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.25	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.472	k star (bias corrected MLE)	1.159
Theta hat (MLE)	3.488	Theta star (bias corrected MLE)	4.428
nu hat (MLE)	35.32	nu star (bias corrected)	27.82
Mean (detects)	5.133		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	1.2	Mean	4.896
Maximum	13	Median	2.054
SD	4.304	CV	0.879
k hat (MLE)	1.493	k star (bias corrected MLE)	1.199
Theta hat (MLE)	3.28	Theta star (bias corrected MLE)	4.082
nu hat (MLE)	38.81	nu star (bias corrected)	31.19
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (31.19, α)	19.43	Adjusted Chi Square Value (31.19, β)	18.11
95% Gamma Approximate UCL (use when n>=50)	7.86	95% Gamma Adjusted UCL (use when n<50)	8.43

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.876	SD (KM)	4.153
Variance (KM)	17.24	SE of Mean (KM)	1.204
k hat (KM)	1.379	k star (KM)	1.112
nu hat (KM)	35.85	nu star (KM)	28.91
theta hat (KM)	3.537	theta star (KM)	4.386
80% gamma percentile (KM)	7.776	90% gamma percentile (KM)	10.94
95% gamma percentile (KM)	14.07	99% gamma percentile (KM)	21.3

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (28.91, α)	17.64	Adjusted Chi Square Value (28.91, β)	16.39
95% Gamma Approximate KM-UCL (use when n>=50)	7.992	95% Gamma Adjusted KM-UCL (use when n<50)	8.599

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.243	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.895	Mean in Log Scale	1.217
SD in Original Scale	4.305	SD in Log Scale	0.893
95% t UCL (assumes normality of ROS data)	7.024	95% Percentile Bootstrap UCL	6.788
95% BCA Bootstrap UCL	7.031	95% Bootstrap t UCL	7.396
95% H-UCL (Log ROS)	10.02		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.204	KM Geo Mean	3.334
KM SD (logged)	0.87	95% Critical H Value (KM-Log)	2.63
KM Standard Error of Mean (logged)	0.253	95% H-UCL (KM -Log)	9.423
KM SD (logged)	0.87	95% Critical H Value (KM-Log)	2.63
KM Standard Error of Mean (logged)	0.253		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.977	Mean in Log Scale	1.249
SD in Original Scale	4.256	SD in Log Scale	0.881
95% t UCL (Assumes normality)	7.081	95% H-Stat UCL	10.09

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	10.12

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	10
Minimum	1.5	Mean	16.98
Maximum	35	Median	17
SD	10.62	Std. Error of Mean	2.946
Coefficient of Variation	0.625	Skewness	0.242

Normal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.141	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	22.23	95% Adjusted-CLT UCL (Chen-1995)	22.04
		95% Modified-t UCL (Johnson-1978)	22.27

Gamma GOF Test

A-D Test Statistic	0.379	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.181	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.24	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.876	k star (bias corrected MLE)	1.494
Theta hat (MLE)	9.056	Theta star (bias corrected MLE)	11.37
nu hat (MLE)	48.77	nu star (bias corrected)	38.85
MLE Mean (bias corrected)	16.98	MLE Sd (bias corrected)	13.9
		Approximate Chi Square Value (0.05)	25.57
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	24.04

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	25.8	95% Adjusted Gamma UCL (use when n<50)	27.44

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.875	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.213	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.405	Mean of logged Data	2.543
Maximum of Logged Data	3.555	SD of logged Data	0.934

Assuming Lognormal Distribution

95% H-UCL	41.1	90% Chebyshev (MVUE) UCL	34.47
95% Chebyshev (MVUE) UCL	41.56	97.5% Chebyshev (MVUE) UCL	51.4
99% Chebyshev (MVUE) UCL	70.74		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	21.83	95% Jackknife UCL	22.23
95% Standard Bootstrap UCL	21.54	95% Bootstrap-t UCL	22.59
95% Hall's Bootstrap UCL	21.91	95% Percentile Bootstrap UCL	21.56
95% BCA Bootstrap UCL	21.68		
90% Chebyshev(Mean, Sd) UCL	25.82	95% Chebyshev(Mean, Sd) UCL	29.83
97.5% Chebyshev(Mean, Sd) UCL	35.38	99% Chebyshev(Mean, Sd) UCL	46.3

Suggested UCL to Use

95% Student's-t UCL	22.23

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	10
Minimum	10.1	Mean	723.5
Maximum	3100	Median	240
SD	1043	Std. Error of Mean	289.2
Coefficient of Variation	1.441	Skewness	1.807

Normal GOF Test

Shapiro Wilk Test Statistic	0.667	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.364	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1239	95% Adjusted-CLT UCL (Chen-1995)	1354
		95% Modified-t UCL (Johnson-1978)	1263

Gamma GOF Test

A-D Test Statistic	0.689	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.782	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.281	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.248	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.601	k star (bias corrected MLE)	0.514
Theta hat (MLE)	1203	Theta star (bias corrected MLE)	1408
nu hat (MLE)	15.64	nu star (bias corrected)	13.36
MLE Mean (bias corrected)	723.5	MLE Sd (bias corrected)	1009
		Approximate Chi Square Value (0.05)	6.137
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	5.454

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1575	95% Adjusted Gamma UCL (use when n<50)	1773

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.912	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.313	Mean of logged Data	5.557
Maximum of Logged Data	8.039	SD of logged Data	1.683

Assuming Lognormal Distribution

95% H-UCL	7880	90% Chebyshev (MVUE) UCL	2217
95% Chebyshev (MVUE) UCL	2830	97.5% Chebyshev (MVUE) UCL	3679
99% Chebyshev (MVUE) UCL	5349		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1199	95% Jackknife UCL	1239
95% Standard Bootstrap UCL	1177	95% Bootstrap-t UCL	2073
95% Hall's Bootstrap UCL	1905	95% Percentile Bootstrap UCL	1222
95% BCA Bootstrap UCL	1349		
90% Chebyshev(Mean, Sd) UCL	1591	95% Chebyshev(Mean, Sd) UCL	1984
97.5% Chebyshev(Mean, Sd) UCL	2530	99% Chebyshev(Mean, Sd) UCL	3601

Suggested UCL to Use

95% Adjusted Gamma UCL	1773

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	10
Minimum	0.15	Mean	4.778
Maximum	13	Median	3.7
SD	4.533	Std. Error of Mean	1.257
Coefficient of Variation	0.949	Skewness	0.541

Normal GOF Test

Shapiro Wilk Test Statistic	0.886	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7.019	95% Adjusted-CLT UCL (Chen-1995)	7.048
		95% Modified-t UCL (Johnson-1978)	7.051

Gamma GOF Test

A-D Test Statistic	0.491	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.771	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.179	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.246	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.738	k star (bias corrected MLE)	0.619
Theta hat (MLE)	6.472	Theta star (bias corrected MLE)	7.717
nu hat (MLE)	19.2	nu star (bias corrected)	16.1
MLE Mean (bias corrected)	4.778	MLE Sd (bias corrected)	6.072
		Approximate Chi Square Value (0.05)	8.033
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	7.234

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	9.577	95% Adjusted Gamma UCL (use when n<50)	10.63

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.897	Mean of logged Data	0.752
Maximum of Logged Data	2.565	SD of logged Data	1.616

Assuming Lognormal Distribution

95% H-UCL	50.41	90% Chebyshev (MVUE) UCL	16.2
95% Chebyshev (MVUE) UCL	20.6	97.5% Chebyshev (MVUE) UCL	26.71
99% Chebyshev (MVUE) UCL	38.71		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6.847	95% Jackknife UCL	7.019
95% Standard Bootstrap UCL	6.776	95% Bootstrap-t UCL	7.448
95% Hall's Bootstrap UCL	6.79	95% Percentile Bootstrap UCL	6.802
95% BCA Bootstrap UCL	6.938		
90% Chebyshev(Mean, Sd) UCL	8.55	95% Chebyshev(Mean, Sd) UCL	10.26
97.5% Chebyshev(Mean, Sd) UCL	12.63	99% Chebyshev(Mean, Sd) UCL	17.29

Suggested UCL to Use

95% Student's-t UCL	7.019

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	10
Number of Detects	9	Number of Non-Detects	4
Number of Distinct Detects	9	Number of Distinct Non-Detects	4
Minimum Detect	0.55	Minimum Non-Detect	0.28
Maximum Detect	7.7	Maximum Non-Detect	1.9
Variance Detects	7.007	Percent Non-Detects	30.77%
Mean Detects	2.457	SD Detects	2.647
Median Detects	0.97	CV Detects	1.078
Skewness Detects	1.351	Kurtosis Detects	0.494
Mean of Logged Detects	0.42	SD of Logged Detects	1.002

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.749	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.349	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.851	KM Standard Error of Mean	0.67
KM SD	2.273	95% KM (BCA) UCL	2.921
95% KM (t) UCL	3.045	95% KM (Percentile Bootstrap) UCL	2.941
95% KM (z) UCL	2.953	95% KM Bootstrap t UCL	4.417
90% KM Chebyshev UCL	3.86	95% KM Chebyshev UCL	4.771
97.5% KM Chebyshev UCL	6.034	99% KM Chebyshev UCL	8.515

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.83	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.74	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.312	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.286	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.183	k star (bias corrected MLE)	0.863
Theta hat (MLE)	2.077	Theta star (bias corrected MLE)	2.847
nu hat (MLE)	21.3	nu star (bias corrected)	15.53
Mean (detects)	2.457		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.744
Maximum	7.7	Median	0.7
SD	2.432	CV	1.394
k hat (MLE)	0.535	k star (bias corrected MLE)	0.463
Theta hat (MLE)	3.258	Theta star (bias corrected MLE)	3.766
nu hat (MLE)	13.92	nu star (bias corrected)	12.04
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (12.04, α)	5.255	Adjusted Chi Square Value (12.04, β)	4.631
95% Gamma Approximate UCL (use when n>=50)	3.997	95% Gamma Adjusted UCL (use when n<50)	4.535

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.851	SD (KM)	2.273
Variance (KM)	5.166	SE of Mean (KM)	0.67
k hat (KM)	0.663	k star (KM)	0.561
nu hat (KM)	17.24	nu star (KM)	14.6
theta hat (KM)	2.791	theta star (KM)	3.297
80% gamma percentile (KM)	3.05	90% gamma percentile (KM)	4.886
95% gamma percentile (KM)	6.821	99% gamma percentile (KM)	11.53

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (14.60, α)	6.983	Adjusted Chi Square Value (14.60, β)	6.246
95% Gamma Approximate KM-UCL (use when n>=50)	3.87	95% Gamma Adjusted KM-UCL (use when n<50)	4.326

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.851	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.822	Mean in Log Scale	-0.0598
SD in Original Scale	2.381	SD in Log Scale	1.175
95% t UCL (assumes normality of ROS data)	2.999	95% Percentile Bootstrap UCL	2.94
95% BCA Bootstrap UCL	3.275	95% Bootstrap t UCL	4.389
95% H-UCL (Log ROS)	5.481		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.0209	KM Geo Mean	1.021
KM SD (logged)	1.032	95% Critical H Value (KM-Log)	2.903
KM Standard Error of Mean (logged)	0.311	95% H-UCL (KM -Log)	4.13
KM SD (logged)	1.032	95% Critical H Value (KM-Log)	2.903
KM Standard Error of Mean (logged)	0.311		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.847	Mean in Log Scale	-0.0362
SD in Original Scale	2.37	SD in Log Scale	1.187
95% t UCL (Assumes normality)	3.019	95% H-Stat UCL	5.801

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	4.771

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	10
Minimum	2.3	Mean	9.296
Maximum	17	Median	10
SD	4.889	Std. Error of Mean	1.356
Coefficient of Variation	0.526	Skewness	0.0526

Normal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.157	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	11.71	95% Adjusted-CLT UCL (Chen-1995)	11.55
		95% Modified-t UCL (Johnson-1978)	11.72

Gamma GOF Test

A-D Test Statistic	0.425	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.238	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.149	k star (bias corrected MLE)	2.474
Theta hat (MLE)	2.952	Theta star (bias corrected MLE)	3.758
nu hat (MLE)	81.88	nu star (bias corrected)	64.31
MLE Mean (bias corrected)	9.296	MLE Sd (bias corrected)	5.911
		Approximate Chi Square Value (0.05)	46.86
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	44.75

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	12.76	95% Adjusted Gamma UCL (use when n<50)	13.36

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.833	Mean of logged Data	2.063
Maximum of Logged Data	2.833	SD of logged Data	0.651

Assuming Lognormal Distribution

95% H-UCL	14.99	90% Chebyshev (MVUE) UCL	14.93
95% Chebyshev (MVUE) UCL	17.36	97.5% Chebyshev (MVUE) UCL	20.75
99% Chebyshev (MVUE) UCL	27.4		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	11.53	95% Jackknife UCL	11.71
95% Standard Bootstrap UCL	11.43	95% Bootstrap-t UCL	11.93
95% Hall's Bootstrap UCL	11.39	95% Percentile Bootstrap UCL	11.43
95% BCA Bootstrap UCL	11.4		
90% Chebyshev(Mean, Sd) UCL	13.36	95% Chebyshev(Mean, Sd) UCL	15.21
97.5% Chebyshev(Mean, Sd) UCL	17.76	99% Chebyshev(Mean, Sd) UCL	22.79

Suggested UCL to Use

95% Student's-t UCL	11.71

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	10
Minimum	7.2	Mean	655.9
Maximum	2400	Median	250
SD	805.4	Std. Error of Mean	223.4
Coefficient of Variation	1.228	Skewness	1.173

Normal GOF Test

Shapiro Wilk Test Statistic	0.788	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.288	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1054	95% Adjusted-CLT UCL (Chen-1995)	1101
		95% Modified-t UCL (Johnson-1978)	1066

Gamma GOF Test

A-D Test Statistic	0.311	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.786	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.15	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.249	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.551	k star (bias corrected MLE)	0.475
Theta hat (MLE)	1190	Theta star (bias corrected MLE)	1380
nu hat (MLE)	14.33	nu star (bias corrected)	12.36
MLE Mean (bias corrected)	655.9	MLE Sd (bias corrected)	951.4
		Approximate Chi Square Value (0.05)	5.463
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	4.826

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1484	95% Adjusted Gamma UCL (use when n<50)	1680

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.136	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.974	Mean of logged Data	5.351
Maximum of Logged Data	7.783	SD of logged Data	1.922

Assuming Lognormal Distribution

95% H-UCL	17239	90% Chebyshev (MVUE) UCL	2731
95% Chebyshev (MVUE) UCL	3522	97.5% Chebyshev (MVUE) UCL	4620
99% Chebyshev (MVUE) UCL	6778		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1023	95% Jackknife UCL	1054
95% Standard Bootstrap UCL	1008	95% Bootstrap-t UCL	1225
95% Hall's Bootstrap UCL	994.4	95% Percentile Bootstrap UCL	1024
95% BCA Bootstrap UCL	1054		
90% Chebyshev(Mean, Sd) UCL	1326	95% Chebyshev(Mean, Sd) UCL	1630
97.5% Chebyshev(Mean, Sd) UCL	2051	99% Chebyshev(Mean, Sd) UCL	2879

Suggested UCL to Use

95% Adjusted Gamma UCL	1680

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	8
Number of Detects	7	Number of Non-Detects	7
Number of Distinct Detects	7	Number of Distinct Non-Detects	7
Minimum Detect	0.27	Minimum Non-Detect	0.055
Maximum Detect	13	Maximum Non-Detect	0.64
Variance Detects	21.28	Percent Non-Detects	50%
Mean Detects	2.717	SD Detects	4.613
Median Detects	0.78	CV Detects	1.698
Skewness Detects	2.47	Kurtosis Detects	6.237
Mean of Logged Detects	0.0837	SD of Logged Detects	1.361

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.603	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.359	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.416	KM Standard Error of Mean	0.95
KM SD	3.289	95% KM (BCA) UCL	3.373
95% KM (t) UCL	3.098	95% KM (Percentile Bootstrap) UCL	3.087
95% KM (z) UCL	2.979	95% KM Bootstrap t UCL	10.71
90% KM Chebyshev UCL	4.266	95% KM Chebyshev UCL	5.557
97.5% KM Chebyshev UCL	7.348	99% KM Chebyshev UCL	10.87

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.608	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.741	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.324	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.665	k star (bias corrected MLE)	0.475
Theta hat (MLE)	4.088	Theta star (bias corrected MLE)	5.72
nu hat (MLE)	9.306	nu star (bias corrected)	6.651
Mean (detects)	2.717		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.364
Maximum	13	Median	0.14
SD	3.434	CV	2.518
k hat (MLE)	0.272	k star (bias corrected MLE)	0.262
Theta hat (MLE)	5.005	Theta star (bias corrected MLE)	5.21
nu hat (MLE)	7.629	nu star (bias corrected)	7.328
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (7.33, α)	2.352	Adjusted Chi Square Value (7.33, β)	1.996
95% Gamma Approximate UCL (use when n>=50)	4.248	95% Gamma Adjusted UCL (use when n<50)	5.006

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.416	SD (KM)	3.289
Variance (KM)	10.82	SE of Mean (KM)	0.95
k hat (KM)	0.185	k star (KM)	0.193
nu hat (KM)	5.19	nu star (KM)	5.411
theta hat (KM)	7.64	theta star (KM)	7.328
80% gamma percentile (KM)	1.832	90% gamma percentile (KM)	4.281
95% gamma percentile (KM)	7.361	99% gamma percentile (KM)	15.89

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.41, α)	1.347	Adjusted Chi Square Value (5.41, β)	1.099
95% Gamma Approximate KM-UCL (use when n>=50)	5.69	95% Gamma Adjusted KM-UCL (use when n<50)	6.974

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.389	Mean in Log Scale	-1.416
SD in Original Scale	3.424	SD in Log Scale	1.843
95% t UCL (assumes normality of ROS data)	3.009	95% Percentile Bootstrap UCL	3.09
95% BCA Bootstrap UCL	3.997	95% Bootstrap t UCL	11.36
95% H-UCL (Log ROS)	12.34		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.217	KM Geo Mean	0.296
KM SD (logged)	1.66	95% Critical H Value (KM-Log)	3.998
KM Standard Error of Mean (logged)	0.507	95% H-UCL (KM -Log)	7.397
KM SD (logged)	1.66	95% Critical H Value (KM-Log)	3.998
KM Standard Error of Mean (logged)	0.507		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.448	Mean in Log Scale	-0.936
SD in Original Scale	3.4	SD in Log Scale	1.519
95% t UCL (Assumes normality)	3.058	95% H-Stat UCL	5.981

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	10.71	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	6.974

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	10
Minimum	5820	Mean	33413
Maximum	71000	Median	21000
SD	23237	Std. Error of Mean	6445
Coefficient of Variation	0.695	Skewness	0.438

Normal GOF Test

Shapiro Wilk Test Statistic	0.871	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.242	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	44900	95% Adjusted-CLT UCL (Chen-1995)	44851
		95% Modified-t UCL (Johnson-1978)	45030

Gamma GOF Test

A-D Test Statistic	0.536	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.183	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.24	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.933	k star (bias corrected MLE)	1.538
Theta hat (MLE)	17284	Theta star (bias corrected MLE)	21721
nu hat (MLE)	50.26	nu star (bias corrected)	40
MLE Mean (bias corrected)	33413	MLE Sd (bias corrected)	26940
		Approximate Chi Square Value (0.05)	26.51
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	24.95

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	50418	95% Adjusted Gamma UCL (use when n<50)	53564

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.669	Mean of logged Data	10.14
Maximum of Logged Data	11.17	SD of logged Data	0.839

Assuming Lognormal Distribution

95% H-UCL	67007	90% Chebyshev (MVUE) UCL	60351
95% Chebyshev (MVUE) UCL	71983	97.5% Chebyshev (MVUE) UCL	88127
99% Chebyshev (MVUE) UCL	119838		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	44014	95% Jackknife UCL	44900
95% Standard Bootstrap UCL	43403	95% Bootstrap-t UCL	47177
95% Hall's Bootstrap UCL	43174	95% Percentile Bootstrap UCL	44123
95% BCA Bootstrap UCL	44315		
90% Chebyshev(Mean, Sd) UCL	52748	95% Chebyshev(Mean, Sd) UCL	61506
97.5% Chebyshev(Mean, Sd) UCL	73661	99% Chebyshev(Mean, Sd) UCL	97539

Suggested UCL to Use

95% Student's-t UCL	44900

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	10
Minimum	4.6	Mean	942.2
Maximum	4200	Median	340
SD	1352	Std. Error of Mean	374.9
Coefficient of Variation	1.435	Skewness	1.736

Normal GOF Test

Shapiro Wilk Test Statistic	0.732	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1610	95% Adjusted-CLT UCL (Chen-1995)	1752
		95% Modified-t UCL (Johnson-1978)	1640

Gamma GOF Test

A-D Test Statistic	0.248	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.804	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.153	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.252	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.431	k star (bias corrected MLE)	0.383
Theta hat (MLE)	2186	Theta star (bias corrected MLE)	2461
nu hat (MLE)	11.21	nu star (bias corrected)	9.953
MLE Mean (bias corrected)	942.2	MLE Sd (bias corrected)	1523
		Approximate Chi Square Value (0.05)	3.912
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	3.39

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2397	95% Adjusted Gamma UCL (use when n<50)	2766

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.526	Mean of logged Data	5.34
Maximum of Logged Data	8.343	SD of logged Data	2.273

Assuming Lognormal Distribution

95% H-UCL	95202	90% Chebyshev (MVUE) UCL	5134
95% Chebyshev (MVUE) UCL	6698	97.5% Chebyshev (MVUE) UCL	8871
99% Chebyshev (MVUE) UCL	13137		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1559	95% Jackknife UCL	1610
95% Standard Bootstrap UCL	1536	95% Bootstrap-t UCL	2363
95% Hall's Bootstrap UCL	3904	95% Percentile Bootstrap UCL	1582
95% BCA Bootstrap UCL	1805		
90% Chebyshev(Mean, Sd) UCL	2067	95% Chebyshev(Mean, Sd) UCL	2576
97.5% Chebyshev(Mean, Sd) UCL	3283	99% Chebyshev(Mean, Sd) UCL	4672

Suggested UCL to Use

95% Adjusted Gamma UCL	2766

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	4
Minimum	3600	Mean	25300
Maximum	47000	Median	25300

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - coarse fraction was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Lead - fine fraction

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	4
Minimum	3600	Mean	15800
Maximum	28000	Median	15800

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - fine fraction was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	2	Number of Distinct Observations	2
		Number of Missing Observations	4
Minimum	3600	Mean	23300
Maximum	43000	Median	23300

Warning: This data set only has 2 observations!
Data set is too small to compute reliable and meaningful statistics and estimates!
The data set for variable Lead - total (calculated by fine/coarse fraction) was not processed!

It is suggested to collect at least 8 to 10 observations before using these statistical methods!
If possible, compute and collect Data Quality Objectives (DQO) based sample size and analytical results.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	10
Minimum	88.1	Mean	366.9
Maximum	880	Median	300
SD	239.6	Std. Error of Mean	66.46
Coefficient of Variation	0.653	Skewness	1.192

Normal GOF Test

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	485.3	95% Adjusted-CLT UCL (Chen-1995)	499.7
		95% Modified-t UCL (Johnson-1978)	489

Gamma GOF Test

A-D Test Statistic	0.406	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.238	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.845	k star (bias corrected MLE)	2.24
Theta hat (MLE)	129	Theta star (bias corrected MLE)	163.8
nu hat (MLE)	73.97	nu star (bias corrected)	58.24
MLE Mean (bias corrected)	366.9	MLE Sd (bias corrected)	245.1
		Approximate Chi Square Value (0.05)	41.69
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	39.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	512.5	95% Adjusted Gamma UCL (use when n<50)	538.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.162	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.478	Mean of logged Data	5.719
Maximum of Logged Data	6.78	SD of logged Data	0.64

Assuming Lognormal Distribution

95% H-UCL	570.4	90% Chebyshev (MVUE) UCL	570.3
95% Chebyshev (MVUE) UCL	662.4	97.5% Chebyshev (MVUE) UCL	790.2
99% Chebyshev (MVUE) UCL	1041		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

General Statistics
Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	476.2	95% Jackknife UCL	485.3
95% Standard Bootstrap UCL	472.2	95% Bootstrap-t UCL	550.1
95% Hall's Bootstrap UCL	515.6	95% Percentile Bootstrap UCL	479.1
95% BCA Bootstrap UCL	490.8		
90% Chebyshev(Mean, Sd) UCL	566.3	95% Chebyshev(Mean, Sd) UCL	656.6
97.5% Chebyshev(Mean, Sd) UCL	781.9	99% Chebyshev(Mean, Sd) UCL	1028

Suggested UCL to Use

95% Adjusted Gamma UCL	538.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	8
Number of Detects	11	Number of Non-Detects	3
Number of Distinct Detects	10	Number of Distinct Non-Detects	3
Minimum Detect	0.11	Minimum Non-Detect	0.1
Maximum Detect	0.98	Maximum Non-Detect	0.64
Variance Detects	0.0841	Percent Non-Detects	21.43%
Mean Detects	0.348	SD Detects	0.29
Median Detects	0.23	CV Detects	0.833
Skewness Detects	1.526	Kurtosis Detects	1.279
Mean of Logged Detects	-1.316	SD of Logged Detects	0.727

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.774	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.293	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.303	KM Standard Error of Mean	0.0741
KM SD	0.263	95% KM (BCA) UCL	0.432
95% KM (t) UCL	0.434	95% KM (Percentile Bootstrap) UCL	0.423
95% KM (z) UCL	0.425	95% KM Bootstrap t UCL	0.578
90% KM Chebyshev UCL	0.525	95% KM Chebyshev UCL	0.626
97.5% KM Chebyshev UCL	0.766	99% KM Chebyshev UCL	1.04

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.626	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.258	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.069	k star (bias corrected MLE)	1.565
Theta hat (MLE)	0.168	Theta star (bias corrected MLE)	0.222
nu hat (MLE)	45.52	nu star (bias corrected)	34.44
Mean (detects)	0.348		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.287
Maximum	0.98	Median	0.2
SD	0.284	CV	0.989
k hat (MLE)	1.011	k star (bias corrected MLE)	0.842
Theta hat (MLE)	0.284	Theta star (bias corrected MLE)	0.341
nu hat (MLE)	28.32	nu star (bias corrected)	23.58
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (23.58, α)	13.53	Adjusted Chi Square Value (23.58, β)	12.53
95% Gamma Approximate UCL (use when n>=50)	0.501	95% Gamma Adjusted UCL (use when n<50)	0.541

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.303	SD (KM)	0.263
Variance (KM)	0.0689	SE of Mean (KM)	0.0741
k hat (KM)	1.331	k star (KM)	1.094
nu hat (KM)	37.28	nu star (KM)	30.63
theta hat (KM)	0.228	theta star (KM)	0.277
80% gamma percentile (KM)	0.484	90% gamma percentile (KM)	0.682
95% gamma percentile (KM)	0.879	99% gamma percentile (KM)	1.334

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (30.63, α)	18.99	Adjusted Chi Square Value (30.63, β)	17.78
95% Gamma Approximate KM-UCL (use when n>=50)	0.489	95% Gamma Adjusted KM-UCL (use when n<50)	0.522

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.296	Mean in Log Scale	-1.547
SD in Original Scale	0.276	SD in Log Scale	0.826
95% t UCL (assumes normality of ROS data)	0.427	95% Percentile Bootstrap UCL	0.421
95% BCA Bootstrap UCL	0.441	95% Bootstrap t UCL	0.557
95% H-UCL (Log ROS)	0.533		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.48	KM Geo Mean	0.228
KM SD (logged)	0.713	95% Critical H Value (KM-Log)	2.354
KM Standard Error of Mean (logged)	0.203	95% H-UCL (KM -Log)	0.467
KM SD (logged)	0.713	95% Critical H Value (KM-Log)	2.354
KM Standard Error of Mean (logged)	0.203		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.304	Mean in Log Scale	-1.53
SD in Original Scale	0.276	SD in Log Scale	0.865
95% t UCL (Assumes normality)	0.435	95% H-Stat UCL	0.584

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.522	95% GROS Adjusted Gamma UCL	0.541

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	10
Minimum	8.4	Mean	26.18
Maximum	46	Median	28
SD	12.76	Std. Error of Mean	3.538
Coefficient of Variation	0.487	Skewness	0.0142

Normal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	32.49	95% Adjusted-CLT UCL (Chen-1995)	32.02
		95% Modified-t UCL (Johnson-1978)	32.49

Gamma GOF Test

A-D Test Statistic	0.413	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.738	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.158	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.238	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.799	k star (bias corrected MLE)	2.974
Theta hat (MLE)	6.893	Theta star (bias corrected MLE)	8.806
nu hat (MLE)	98.77	nu star (bias corrected)	77.31
MLE Mean (bias corrected)	26.18	MLE Sd (bias corrected)	15.18
		Approximate Chi Square Value (0.05)	58.06
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	55.68

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	34.87	95% Adjusted Gamma UCL (use when n<50)	36.35

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.128	Mean of logged Data	3.128
Maximum of Logged Data	3.829	SD of logged Data	0.582

Assuming Lognormal Distribution

95% H-UCL	39.2	90% Chebyshev (MVUE) UCL	39.98
95% Chebyshev (MVUE) UCL	46.02	97.5% Chebyshev (MVUE) UCL	54.4
99% Chebyshev (MVUE) UCL	70.87		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	32	95% Jackknife UCL	32.49
95% Standard Bootstrap UCL	31.76	95% Bootstrap-t UCL	32.15
95% Hall's Bootstrap UCL	31.87	95% Percentile Bootstrap UCL	31.83
95% BCA Bootstrap UCL	31.78		
90% Chebyshev(Mean, Sd) UCL	36.8	95% Chebyshev(Mean, Sd) UCL	41.61
97.5% Chebyshev(Mean, Sd) UCL	48.28	99% Chebyshev(Mean, Sd) UCL	61.39

Suggested UCL to Use

95% Student's-t UCL	32.49

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	10
Minimum	23.2	Mean	926.6
Maximum	3000	Median	310
SD	1082	Std. Error of Mean	300.2
Coefficient of Variation	1.168	Skewness	0.862

Normal GOF Test

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1462	95% Adjusted-CLT UCL (Chen-1995)	1497
		95% Modified-t UCL (Johnson-1978)	1474

Gamma GOF Test

A-D Test Statistic	0.575	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.785	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.171	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.249	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.563	k star (bias corrected MLE)	0.485
Theta hat (MLE)	1645	Theta star (bias corrected MLE)	1912
nu hat (MLE)	14.65	nu star (bias corrected)	12.6
MLE Mean (bias corrected)	926.6	MLE Sd (bias corrected)	1331
		Approximate Chi Square Value (0.05)	5.625
Adjusted Level of Significance	0.0301	Adjusted Chi Square Value	4.977

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2076	95% Adjusted Gamma UCL (use when n<50)	2346

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.866	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.159	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.234	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.144	Mean of logged Data	5.724
Maximum of Logged Data	8.006	SD of logged Data	1.812

Assuming Lognormal Distribution

95% H-UCL	15491	90% Chebyshev (MVUE) UCL	3273
95% Chebyshev (MVUE) UCL	4203	97.5% Chebyshev (MVUE) UCL	5493
99% Chebyshev (MVUE) UCL	8027		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1420	95% Jackknife UCL	1462
95% Standard Bootstrap UCL	1388	95% Bootstrap-t UCL	1573
95% Hall's Bootstrap UCL	1370	95% Percentile Bootstrap UCL	1424
95% BCA Bootstrap UCL	1443		
90% Chebyshev(Mean, Sd) UCL	1827	95% Chebyshev(Mean, Sd) UCL	2235
97.5% Chebyshev(Mean, Sd) UCL	2801	99% Chebyshev(Mean, Sd) UCL	3913

Suggested UCL to Use

95% Adjusted Gamma UCL	2346

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	9
Number of Detects	1	Number of Non-Detects	12
Number of Distinct Detects	1	Number of Distinct Non-Detects	11

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1242 (PCB-1242) was not processed!

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	9
Number of Detects	1	Number of Non-Detects	12
Number of Distinct Detects	1	Number of Distinct Non-Detects	11

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1248 (PCB-1248) was not processed!

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	9
Number of Detects	7	Number of Non-Detects	6
Number of Distinct Detects	7	Number of Distinct Non-Detects	6
Minimum Detect	54	Minimum Non-Detect	25
Maximum Detect	3700	Maximum Non-Detect	510
Variance Detects	1705533	Percent Non-Detects	46.15%
Mean Detects	770.4	SD Detects	1306
Median Detects	330	CV Detects	1.695
Skewness Detects	2.529	Kurtosis Detects	6.518
Mean of Logged Detects	5.756	SD of Logged Detects	1.368

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.59	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.403	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	434.2	KM Standard Error of Mean	287.7
KM SD	959.7	95% KM (BCA) UCL	989.4
95% KM (t) UCL	947	95% KM (Percentile Bootstrap) UCL	946.8
95% KM (z) UCL	907.4	95% KM Bootstrap t UCL	2558
90% KM Chebyshev UCL	1297	95% KM Chebyshev UCL	1688
97.5% KM Chebyshev UCL	2231	99% KM Chebyshev UCL	3297

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.554	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.262	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.324	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.681	k star (bias corrected MLE)	0.484
Theta hat (MLE)	1131	Theta star (bias corrected MLE)	1590
nu hat (MLE)	9.535	nu star (bias corrected)	6.782
Mean (detects)	770.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	414.9
Maximum	3700	Median	54
SD	1006	CV	2.426
k hat (MLE)	0.152	k star (bias corrected MLE)	0.168
Theta hat (MLE)	2733	Theta star (bias corrected MLE)	2468
nu hat (MLE)	3.947	nu star (bias corrected)	4.37
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (4.37, α)	0.873	Adjusted Chi Square Value (4.37, β)	0.677
95% Gamma Approximate UCL (use when n>=50)	2077	95% Gamma Adjusted UCL (use when n<50)	2677

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	434.2	SD (KM)	959.7
Variance (KM)	920993	SE of Mean (KM)	287.7
k hat (KM)	0.205	k star (KM)	0.209
nu hat (KM)	5.321	nu star (KM)	5.427
theta hat (KM)	2121	theta star (KM)	2080
80% gamma percentile (KM)	584.6	90% gamma percentile (KM)	1313
95% gamma percentile (KM)	2212	99% gamma percentile (KM)	4670

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.43, α)	1.354	Adjusted Chi Square Value (5.43, β)	1.088
95% Gamma Approximate KM-UCL (use when n>=50)	1740	95% Gamma Adjusted KM-UCL (use when n<50)	2165

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	423.7	Mean in Log Scale	4.387
SD in Original Scale	1002	SD in Log Scale	1.853
95% t UCL (assumes normality of ROS data)	919.2	95% Percentile Bootstrap UCL	959.9
95% BCA Bootstrap UCL	1279	95% Bootstrap t UCL	3151
95% H-UCL (Log ROS)	4832		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.672	KM Geo Mean	106.9
KM SD (logged)	1.547	95% Critical H Value (KM-Log)	3.87
KM Standard Error of Mean (logged)	0.474	95% H-UCL (KM -Log)	1988
KM SD (logged)	1.547	95% Critical H Value (KM-Log)	3.87
KM Standard Error of Mean (logged)	0.474		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	442.4	Mean in Log Scale	4.662
SD in Original Scale	996.3	SD in Log Scale	1.723
95% t UCL (Assumes normality)	934.9	95% H-Stat UCL	3740

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	2558	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	2165

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260)

General Statistics

Total Number of Observations	13	Number of Distinct Observations	12
		Number of Missing Observations	9
Number of Detects	3	Number of Non-Detects	10
Number of Distinct Detects	3	Number of Distinct Non-Detects	9
Minimum Detect	250	Minimum Non-Detect	24
Maximum Detect	14000	Maximum Non-Detect	420
Variance Detects	62162033	Percent Non-Detects	76.92%
Mean Detects	4897	SD Detects	7884
Median Detects	440	CV Detects	1.61
Skewness Detects	1.731	Kurtosis Detects	N/A
Mean of Logged Detects	7.052	SD of Logged Detects	2.179

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.76	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.381	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1150	KM Standard Error of Mean	1261
KM SD	3711	95% KM (BCA) UCL	N/A
95% KM (t) UCL	3397	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	3224	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	4932	95% KM Chebyshev UCL	6646
97.5% KM Chebyshev UCL	9023	99% KM Chebyshev UCL	13694

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.447	k star (bias corrected MLE)	N/A
Theta hat (MLE)	10944	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	2.685	nu star (bias corrected)	N/A
Mean (detects)	4897		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1130
Maximum	14000	Median	0.01
SD	3869	CV	3.424
k hat (MLE)	0.0918	k star (bias corrected MLE)	0.122
Theta hat (MLE)	12315	Theta star (bias corrected MLE)	9273
nu hat (MLE)	2.386	nu star (bias corrected)	3.169
Adjusted Level of Significance (β)	0.0301		
Approximate Chi Square Value (3.17, α)	0.424	Adjusted Chi Square Value (3.17, β)	0.313
95% Gamma Approximate UCL (use when n>=50)	8444	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1150	SD (KM)	3711
Variance (KM)	13774582	SE of Mean (KM)	1261
k hat (KM)	0.096	k star (KM)	0.125
nu hat (KM)	2.497	nu star (KM)	3.254
theta hat (KM)	11976	theta star (KM)	9190
80% gamma percentile (KM)	1056	90% gamma percentile (KM)	3295
95% gamma percentile (KM)	6527	99% gamma percentile (KM)	16289

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.25, α)	0.452	Adjusted Chi Square Value (3.25, β)	0.334
95% Gamma Approximate KM-UCL (use when n>=50)	8289	95% Gamma Adjusted KM-UCL (use when n<50)	11198

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1130	Mean in Log Scale	0.979
SD in Original Scale	3869	SD in Log Scale	3.648
95% t UCL (assumes normality of ROS data)	3043	95% Percentile Bootstrap UCL	3265
95% BCA Bootstrap UCL	4380	95% Bootstrap t UCL	63241
95% H-UCL (Log ROS)	13777721		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.09	KM Geo Mean	59.74
KM SD (logged)	1.845	95% Critical H Value (KM-Log)	4.432
KM Standard Error of Mean (logged)	0.631	95% H-UCL (KM -Log)	3471
KM SD (logged)	1.845	95% Critical H Value (KM-Log)	4.432
KM Standard Error of Mean (logged)	0.631		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1157	Mean in Log Scale	3.931
SD in Original Scale	3861	SD in Log Scale	2.128
95% t UCL (Assumes normality)	3066	95% H-Stat UCL	11187

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	3397

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin

General Statistics

Total Number of Observations	13	Number of Distinct Observations	13
		Number of Missing Observations	9
Number of Detects	2	Number of Non-Detects	11
Number of Distinct Detects	2	Number of Distinct Non-Detects	11
Minimum Detect	12	Minimum Non-Detect	0.97
Maximum Detect	270	Maximum Non-Detect	65
Variance Detects	33282	Percent Non-Detects	84.62%
Mean Detects	141	SD Detects	182.4
Median Detects	141	CV Detects	1.294
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	4.042	SD of Logged Detects	2.202

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	22.8	KM Standard Error of Mean	28.03
KM SD	71.44	95% KM (BCA) UCL	N/A
95% KM (t) UCL	72.76	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	68.9	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	106.9	95% KM Chebyshev UCL	145
97.5% KM Chebyshev UCL	197.8	99% KM Chebyshev UCL	301.7

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.67	k star (bias corrected MLE)	N/A
Theta hat (MLE)	210.3	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	2.681	nu star (bias corrected)	N/A
Mean (detects)	141		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	22.8	SD (KM)	71.44
Variance (KM)	5104	SE of Mean (KM)	28.03
k hat (KM)	0.102	k star (KM)	0.13
nu hat (KM)	2.647	nu star (KM)	3.37
theta hat (KM)	223.9	theta star (KM)	175.9
80% gamma percentile (KM)	21.71	90% gamma percentile (KM)	65.84
95% gamma percentile (KM)	128.7	99% gamma percentile (KM)	317

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0301
Approximate Chi Square Value (3.37, α)	0.49	Adjusted Chi Square Value (3.37, β)	0.364
95% Gamma Approximate KM-UCL (use when n>=50)	156.8	95% Gamma Adjusted KM-UCL (use when n<50)	210.9

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	21.71	Mean in Log Scale	-2.788
SD in Original Scale	74.68	SD in Log Scale	3.109
95% t UCL (assumes normality of ROS data)	58.62	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	4874		

Table B.12.4

Summary of ProUCL Output for EU14 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 1:00:59 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.661	KM Geo Mean	1.936
KM SD (logged)	1.615	95% Critical H Value (KM-Log)	3.993
KM Standard Error of Mean (logged)	0.656	95% H-UCL (KM -Log)	45.92
KM SD (logged)	1.615	95% Critical H Value (KM-Log)	3.993
KM Standard Error of Mean (logged)	0.656		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	28.69	Mean in Log Scale	1.692
SD in Original Scale	73.29	SD in Log Scale	1.763
95% t UCL (Assumes normality)	64.92	95% H-Stat UCL	223.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM Chebyshev UCL	145

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.1

Summary of ProUCL Input Data for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Trichloroethene	D_Trichloroethene	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS	350	0	4300	1						
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS	4.5	0	1.5	1						
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS										
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	0.685	0	0.625	0	135	1	115	1	165	1
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	15	0	850	1	180	1	140	1	190	1
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	0.615	0	3400	1	7050	1	6350	1	8850	1
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS			3.7	1	200	1	220	1	400	1
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	5.3	1			4.6	0	13	0	8.8	0
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	12	0	3000	1	79	1	88	1	160	1
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	15	0	700	1	260	1	320	1	370	1
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	0.99	0	8.1	1	36	1	41	1	83	1
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	0.91	0	3.7	1	600	1	690	1	1100	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	0.69	0	0.63	0	34	1	34	1	57	1
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS										
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS										
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS										

Table B.13.1

Summary of ProUCL Input Data for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				10	11	12	13	14	15	16	17	18	19	20	21
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS												
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS												
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS												
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	35	1	18	1	79.5	1	12500	1	0.33	1	10.75	1
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	33	1	29	1	84	1	2800	1	0.49	1	4.7	1
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	1025	1	1230	1	4150	1	6850	1	6.9	1	26.5	1
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	20	0	70	1	200	1	6400	1	3.2	1	11	1
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	26	0	9.4	0	10	0	7200	1	1.3	1	17	1
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	22	0	24	1	69	1	5000	1	0.29	1	6.2	1
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	290	0	110	0	240	1	10000	1	12	1	24	1
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	24	0	8.7	0	38	1	8600	1	4.4	1	19	1
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	50	1	140	1	460	1	6400	1	4.8	1	9.5	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	20	0	7.3	0	29	1	4700	1	1	1	9.2	1
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS												
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS												

Table B.13.1

Summary of ProUCL Input Data for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				22	23	24	25	26	27	28	29	30	31	32	33	34	35
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Barium	D_Barium	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS														
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS														
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS														
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	88.5	1	0.4	1	0.74	1	8.55	1	30.5	1	0.235	0	23000	1
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	160	1	0.28	1	0.25	0	3.2	1	25	1	0.2	0	8800	1
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	980	1	4.8	1	6	1	11.5	1	800	1	0.49	0	32500	1
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	1200	1	3.7	1	0.86	1	8.4	1	490	1	0.21	0	28000	1
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	180	1	1.2	1	0.77	1	11	1	36	1	2.8	0	9700	1
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	54	1	0.27	1	0.99	1	4.2	1	17	1	0.22	0	12000	1
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	2900	1	16	1	1.5	0	29	1	2900	1	41	1	100000	1
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	720	1	3.5	1	1.5	0	24	1	730	1	6.5	1	110000	1
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	760	1	3.8	1	1.3	0	9	1	620	1	0.62	1	26000	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	100	1	1.4	1	0.9	1	3.9	1	130	1	0.2	0	15000	1
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS														
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS														
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS														

Table B.13.1

Summary of ProUCL Input Data for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				36	37	38	39	40	41	42	43
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Lead	D_Lead	Lead - coarse fraction	D_Lead - coarse fraction	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS								
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS								
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS								
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	97.5	1						
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	20	1	18	1	26	1	19	1
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	1720	1						
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	510	1						
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	15	1						
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	21	1						
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	2200	1	2000	1	2700	1	2200	1
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	490	1						
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	720	1	1600	1	2000	1	1700	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	220	1						
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS								
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS								
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS								

Table B.13.1

Summary of ProUCL Input Data for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				44	45	46	47	48	49	50	51	52	53	54	55
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Manganese	D_Manganese	Mercury	D_Mercury	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc	Aroclor-1232 (PCB-1232)	D_Aroclor-1232 (PCB-1232)
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS												
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS												
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS												
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	405	1	3.2	1	0.27	1	30	1	75	1	27.5	0
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	390	1	0.019	0	0.075	1	12	1	61	1	24	0
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	1100	1	0.26	1	0.345	1	19	1	1450	1	25	0
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	340	1	0.19	1	0.26	1	18	1	830	1	23	0
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	34	1	0.22	1	0.65	1	29	1	500	1	32	0
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	320	1	0.051	1	0.13	1	16	1	45	1	26	0
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	820	1	0.66	1	0.22	1	50	1	5600	1	140	0
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	670	1	0.28	1	0.35	1	29	1	1600	1	30	0
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	450	1	0.19	1	0.21	1	17	1	920	1	1100	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	350	1	0.021	1	0.096	1	10	1	890	1	24	0
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS												
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS												

Table B.13.1

Summary of ProUCL Input Data for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				56	57	58	59	60	61	62	63
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Aroclor-1260 (PCB-1260)	D_Aroclor-1260 (PCB-1260)
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS								
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS								
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS								
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	23	0	29	0	86	1	26.5	0
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	20	0	25	0	24	0	23	0
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	31.5	0	1600	1	22	0	770	1
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	19	0	24	0	150	1	22	0
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	26	0	33	0	32	0	30	0
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	22	0	28	0	26	0	170	1
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	1100	1	150	0	1800	1	140	0
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	25	0	32	0	30	0	29	0
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	200	0	260	0	410	1	240	0
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	20	0	25	0	24	0	44	1
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS								
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS								
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS								

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	2
Number of Detects	1	Number of Non-Detects	10
Number of Distinct Detects	1	Number of Distinct Non-Detects	9

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,1-Dichloroethane was not processed!

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	2
Number of Detects	9	Number of Non-Detects	2
Number of Distinct Detects	8	Number of Distinct Non-Detects	2
Minimum Detect	1.5	Minimum Non-Detect	0.625
Maximum Detect	4300	Maximum Non-Detect	0.63
Variance Detects	2942834	Percent Non-Detects	18.18%
Mean Detects	1363	SD Detects	1715
Median Detects	700	CV Detects	1.259
Skewness Detects	0.882	Kurtosis Detects	-1.086
Mean of Logged Detects	4.768	SD of Logged Detects	3.391

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.787	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1115	KM Standard Error of Mean	497.1
KM SD	1554	95% KM (BCA) UCL	1951
95% KM (t) UCL	2016	95% KM (Percentile Bootstrap) UCL	1914
95% KM (z) UCL	1933	95% KM Bootstrap t UCL	2325
90% KM Chebyshev UCL	2607	95% KM Chebyshev UCL	3282
97.5% KM Chebyshev UCL	4220	99% KM Chebyshev UCL	6062

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.709	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.814	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.263	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.303	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.284	k star (bias corrected MLE)	0.263
Theta hat (MLE)	4798	Theta star (bias corrected MLE)	5174
nu hat (MLE)	5.113	nu star (bias corrected)	4.742
Mean (detects)	1363		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	1.5	Mean	1132
Maximum	4300	Median	94.95
SD	1618	CV	1.429
k hat (MLE)	0.3	k star (bias corrected MLE)	0.278
Theta hat (MLE)	3781	Theta star (bias corrected MLE)	4067
nu hat (MLE)	6.589	nu star (bias corrected)	6.125
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (6.13, α)	1.704	Adjusted Chi Square Value (6.13, β)	1.353
95% Gamma Approximate UCL (use when n>=50)	4070	95% Gamma Adjusted UCL (use when n<50)	5126

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1115	SD (KM)	1554
Variance (KM)	2416352	SE of Mean (KM)	497.1
k hat (KM)	0.515	k star (KM)	0.435
nu hat (KM)	11.33	nu star (KM)	9.57
theta hat (KM)	2167	theta star (KM)	2564
80% gamma percentile (KM)	1815	90% gamma percentile (KM)	3102
95% gamma percentile (KM)	4501	99% gamma percentile (KM)	7987

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.57, α)	3.675	Adjusted Chi Square Value (9.57, β)	3.103
95% Gamma Approximate KM-UCL (use when n>=50)	2904	95% Gamma Adjusted KM-UCL (use when n<50)	3440

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.816	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1115	Mean in Log Scale	3.377
SD in Original Scale	1630	SD in Log Scale	4.333
95% t UCL (assumes normality of ROS data)	2006	95% Percentile Bootstrap UCL	1942
95% BCA Bootstrap UCL	2038	95% Bootstrap t UCL	2394
95% H-UCL (Log ROS)	7.859E+11		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.816	KM Geo Mean	45.42
KM SD (logged)	3.527	95% Critical H Value (KM-Log)	8.732
KM Standard Error of Mean (logged)	1.128	95% H-UCL (KM -Log)	3.886E+8
KM SD (logged)	3.527	95% Critical H Value (KM-Log)	8.732
KM Standard Error of Mean (logged)	1.128		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1115	Mean in Log Scale	3.691
SD in Original Scale	1630	SD in Log Scale	3.866
95% t UCL (Assumes normality)	2006	95% H-Stat UCL	8.261E+9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	2325	Gamma Adjusted KM-UCL (use if k<=1 and 15< n<50 but k<=1)	3440

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	9	Number of Non-Detects	1
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	34	Minimum Non-Detect	4.6
Maximum Detect	7050	Maximum Non-Detect	4.6
Variance Detects	5257657	Percent Non-Detects	10%
Mean Detects	952.7	SD Detects	2293
Median Detects	180	CV Detects	2.407
Skewness Detects	2.968	Kurtosis Detects	8.854
Mean of Logged Detects	5.299	SD of Logged Detects	1.623

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.451	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.45	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	857.9	KM Standard Error of Mean	694.5
KM SD	2071	95% KM (BCA) UCL	2244
95% KM (t) UCL	2131	95% KM (Percentile Bootstrap) UCL	2210
95% KM (z) UCL	2000	95% KM Bootstrap t UCL	19826
90% KM Chebyshev UCL	2941	95% KM Chebyshev UCL	3885
97.5% KM Chebyshev UCL	5195	99% KM Chebyshev UCL	7768

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.192	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.786	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.338	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.297	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.419	k star (bias corrected MLE)	0.353
Theta hat (MLE)	2275	Theta star (bias corrected MLE)	2697
nu hat (MLE)	7.538	nu star (bias corrected)	6.358
Mean (detects)	952.7		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	857.4
Maximum	7050	Median	157.5
SD	2183	CV	2.546
k hat (MLE)	0.284	k star (bias corrected MLE)	0.266
Theta hat (MLE)	3014	Theta star (bias corrected MLE)	3226
nu hat (MLE)	5.69	nu star (bias corrected)	5.316
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (5.32, α)	1.301	Adjusted Chi Square Value (5.32, β)	0.99
95% Gamma Approximate UCL (use when n>=50)	3504	95% Gamma Adjusted UCL (use when n<50)	4602

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	857.9	SD (KM)	2071
Variance (KM)	4287020	SE of Mean (KM)	694.5
k hat (KM)	0.172	k star (KM)	0.187
nu hat (KM)	3.433	nu star (KM)	3.737
theta hat (KM)	4997	theta star (KM)	4592
80% gamma percentile (KM)	1089	90% gamma percentile (KM)	2591
95% gamma percentile (KM)	4497	99% gamma percentile (KM)	9805

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.74, α)	0.62	Adjusted Chi Square Value (3.74, β)	0.44
95% Gamma Approximate KM-UCL (use when n>=50)	5166	95% Gamma Adjusted KM-UCL (use when n<50)	7290

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	857.8	Mean in Log Scale	4.915
SD in Original Scale	2183	SD in Log Scale	1.955
95% t UCL (assumes normality of ROS data)	2123	95% Percentile Bootstrap UCL	2206
95% BCA Bootstrap UCL	2952	95% Bootstrap t UCL	19623
95% H-UCL (Log ROS)	28844		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.922	KM Geo Mean	137.3
KM SD (logged)	1.841	95% Critical H Value (KM-Log)	5.012
KM Standard Error of Mean (logged)	0.617	95% H-UCL (KM -Log)	16189
KM SD (logged)	1.841	95% Critical H Value (KM-Log)	5.012
KM Standard Error of Mean (logged)	0.617		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	857.6	Mean in Log Scale	4.853
SD in Original Scale	2183	SD in Log Scale	2.082
95% t UCL (Assumes normality)	2123	95% H-Stat UCL	54475

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	5195	99% KM (Chebyshev) UCL	7768

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	9	Number of Non-Detects	1
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	34	Minimum Non-Detect	13
Maximum Detect	6350	Maximum Non-Detect	13
Variance Detects	4235656	Percent Non-Detects	10%
Mean Detects	888.7	SD Detects	2058
Median Detects	140	CV Detects	2.316
Skewness Detects	2.946	Kurtosis Detects	8.747
Mean of Logged Detects	5.318	SD of Logged Detects	1.6

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.469	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.427	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	801.1	KM Standard Error of Mean	623.7
KM SD	1859	95% KM (BCA) UCL	2015
95% KM (t) UCL	1944	95% KM (Percentile Bootstrap) UCL	1996
95% KM (z) UCL	1827	95% KM Bootstrap t UCL	14723
90% KM Chebyshev UCL	2672	95% KM Chebyshev UCL	3520
97.5% KM Chebyshev UCL	4696	99% KM Chebyshev UCL	7007

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.065	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.782	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.299	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.296	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.44	k star (bias corrected MLE)	0.368
Theta hat (MLE)	2019	Theta star (bias corrected MLE)	2418
nu hat (MLE)	7.924	nu star (bias corrected)	6.616
Mean (detects)	888.7		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	799.8
Maximum	6350	Median	127.5
SD	1961	CV	2.451
k hat (MLE)	0.293	k star (bias corrected MLE)	0.272
Theta hat (MLE)	2726	Theta star (bias corrected MLE)	2940
nu hat (MLE)	5.868	nu star (bias corrected)	5.441
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (5.44, α)	1.361	Adjusted Chi Square Value (5.44, β)	1.041
95% Gamma Approximate UCL (use when n>=50)	3197	95% Gamma Adjusted UCL (use when n<50)	4181

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	801.1	SD (KM)	1859
Variance (KM)	3457536	SE of Mean (KM)	623.7
k hat (KM)	0.186	k star (KM)	0.197
nu hat (KM)	3.712	nu star (KM)	3.932
theta hat (KM)	4316	theta star (KM)	4075
80% gamma percentile (KM)	1046	90% gamma percentile (KM)	2423
95% gamma percentile (KM)	4146	99% gamma percentile (KM)	8905

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.93, α)	0.695	Adjusted Chi Square Value (3.93, β)	0.498
95% Gamma Approximate KM-UCL (use when n>=50)	4532	95% Gamma Adjusted KM-UCL (use when n<50)	6330

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.167	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	800.2	Mean in Log Scale	4.933
SD in Original Scale	1960	SD in Log Scale	1.937
95% t UCL (assumes normality of ROS data)	1937	95% Percentile Bootstrap UCL	2005
95% BCA Bootstrap UCL	2666	95% Bootstrap t UCL	14618
95% H-UCL (Log ROS)	26790		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.042	KM Geo Mean	154.8
KM SD (logged)	1.652	95% Critical H Value (KM-Log)	4.562
KM Standard Error of Mean (logged)	0.554	95% H-UCL (KM -Log)	7478
KM SD (logged)	1.652	95% Critical H Value (KM-Log)	4.562
KM Standard Error of Mean (logged)	0.554		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	800.5	Mean in Log Scale	4.973
SD in Original Scale	1960	SD in Log Scale	1.861
95% t UCL (Assumes normality)	1937	95% H-Stat UCL	18819

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	4696	99% KM (Chebyshev) UCL	7007

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	9	Number of Non-Detects	1
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	57	Minimum Non-Detect	8.8
Maximum Detect	8850	Maximum Non-Detect	8.8
Variance Detects	8193966	Percent Non-Detects	10%
Mean Detects	1264	SD Detects	2863
Median Detects	190	CV Detects	2.265
Skewness Detects	2.932	Kurtosis Detects	8.679
Mean of Logged Detects	5.765	SD of Logged Detects	1.525

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.474	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.412	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1138	KM Standard Error of Mean	868
KM SD	2588	95% KM (BCA) UCL	2835
95% KM (t) UCL	2730	95% KM (Percentile Bootstrap) UCL	2821
95% KM (z) UCL	2566	95% KM Bootstrap t UCL	21032
90% KM Chebyshev UCL	3742	95% KM Chebyshev UCL	4922
97.5% KM Chebyshev UCL	6559	99% KM Chebyshev UCL	9775

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.144	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.777	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.336	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.295	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.466	k star (bias corrected MLE)	0.385
Theta hat (MLE)	2710	Theta star (bias corrected MLE)	3283
nu hat (MLE)	8.395	nu star (bias corrected)	6.93
Mean (detects)	1264		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1138
Maximum	8850	Median	177.5
SD	2728	CV	2.398
k hat (MLE)	0.299	k star (bias corrected MLE)	0.276
Theta hat (MLE)	3806	Theta star (bias corrected MLE)	4123
nu hat (MLE)	5.978	nu star (bias corrected)	5.518
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (5.52, α)	1.399	Adjusted Chi Square Value (5.52, β)	1.072
95% Gamma Approximate UCL (use when n>=50)	4488	95% Gamma Adjusted UCL (use when n<50)	5853

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1138	SD (KM)	2588
Variance (KM)	6696945	SE of Mean (KM)	868
k hat (KM)	0.194	k star (KM)	0.202
nu hat (KM)	3.87	nu star (KM)	4.042
theta hat (KM)	5883	theta star (KM)	5632
80% gamma percentile (KM)	1508	90% gamma percentile (KM)	3443
95% gamma percentile (KM)	5849	99% gamma percentile (KM)	12463

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.04, α)	0.739	Adjusted Chi Square Value (4.04, β)	0.532
95% Gamma Approximate KM-UCL (use when n>=50)	6231	95% Gamma Adjusted KM-UCL (use when n<50)	8653

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.889	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1138	Mean in Log Scale	5.403
SD in Original Scale	2728	SD in Log Scale	1.837
95% t UCL (assumes normality of ROS data)	2720	95% Percentile Bootstrap UCL	2790
95% BCA Bootstrap UCL	3757	95% Bootstrap t UCL	21015
95% H-UCL (Log ROS)	25750		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.406	KM Geo Mean	222.8
KM SD (logged)	1.738	95% Critical H Value (KM-Log)	4.766
KM Standard Error of Mean (logged)	0.583	95% H-UCL (KM -Log)	15959
KM SD (logged)	1.738	95% Critical H Value (KM-Log)	4.766
KM Standard Error of Mean (logged)	0.583		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1138	Mean in Log Scale	5.337
SD in Original Scale	2728	SD in Log Scale	1.975
95% t UCL (Assumes normality)	2719	95% H-Stat UCL	49097

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	6559	99% KM (Chebyshev) UCL	9775

Warning: Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	4	Number of Non-Detects	6
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	33	Minimum Non-Detect	20
Maximum Detect	1025	Maximum Non-Detect	290
Variance Detects	242942	Percent Non-Detects	60%
Mean Detects	285.8	SD Detects	492.9
Median Detects	42.5	CV Detects	1.725
Skewness Detects	1.999	Kurtosis Detects	3.995
Mean of Logged Detects	4.474	SD of Logged Detects	1.649

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.642	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.434	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	127	KM Standard Error of Mean	109.4
KM SD	299.5	95% KM (BCA) UCL	N/A
95% KM (t) UCL	327.5	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	306.9	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	455.1	95% KM Chebyshev UCL	603.7
97.5% KM Chebyshev UCL	810	99% KM Chebyshev UCL	1215

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.81	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.68	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.442	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.41	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.533	k star (bias corrected MLE)	0.3
Theta hat (MLE)	536.5	Theta star (bias corrected MLE)	953.1
nu hat (MLE)	4.261	nu star (bias corrected)	2.399
Mean (detects)	285.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	114.3
Maximum	1025	Median	0.01
SD	320.6	CV	2.804
k hat (MLE)	0.136	k star (bias corrected MLE)	0.162
Theta hat (MLE)	838.1	Theta star (bias corrected MLE)	705
nu hat (MLE)	2.728	nu star (bias corrected)	3.243
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (3.24, α)	0.448	Adjusted Chi Square Value (3.24, β)	0.31
95% Gamma Approximate UCL (use when n>=50)	827.7	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	127	SD (KM)	299.5
Variance (KM)	89694	SE of Mean (KM)	109.4
k hat (KM)	0.18	k star (KM)	0.193
nu hat (KM)	3.598	nu star (KM)	3.852
theta hat (KM)	706.1	theta star (KM)	659.6
80% gamma percentile (KM)	164	90% gamma percentile (KM)	384
95% gamma percentile (KM)	660.9	99% gamma percentile (KM)	1428

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.85, α)	0.664	Adjusted Chi Square Value (3.85, β)	0.473
95% Gamma Approximate KM-UCL (use when n>=50)	736.8	95% Gamma Adjusted KM-UCL (use when n<50)	1033

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.718	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.383	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	115.5	Mean in Log Scale	2.072
SD in Original Scale	320.1	SD in Log Scale	2.343
95% t UCL (assumes normality of ROS data)	301.1	95% Percentile Bootstrap UCL	315.3
95% BCA Bootstrap UCL	418.8	95% Bootstrap t UCL	2615
95% H-UCL (Log ROS)	16115		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.612	KM Geo Mean	37.03
KM SD (logged)	1.152	95% Critical H Value (KM-Log)	3.424
KM Standard Error of Mean (logged)	0.423	95% H-UCL (KM -Log)	268.1
KM SD (logged)	1.152	95% Critical H Value (KM-Log)	3.424
KM Standard Error of Mean (logged)	0.423		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	134.4	Mean in Log Scale	3.493
SD in Original Scale	315.6	SD in Log Scale	1.495
95% t UCL (Assumes normality)	317.4	95% H-Stat UCL	813.8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

975% KM (Chebyshev) UCL	810

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	6	Number of Non-Detects	4
Number of Distinct Detects	6	Number of Distinct Non-Detects	4
Minimum Detect	18	Minimum Non-Detect	7.3
Maximum Detect	1230	Maximum Non-Detect	110
Variance Detects	231724	Percent Non-Detects	40%
Mean Detects	251.8	SD Detects	481.4
Median Detects	49.5	CV Detects	1.911
Skewness Detects	2.401	Kurtosis Detects	5.807
Mean of Logged Detects	4.29	SD of Logged Detects	1.578

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.574	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.425	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	155.6	KM Standard Error of Mean	124.8
KM SD	360.3	95% KM (BCA) UCL	396.2
95% KM (t) UCL	384.4	95% KM (Percentile Bootstrap) UCL	390.7
95% KM (z) UCL	360.9	95% KM Bootstrap t UCL	2354
90% KM Chebyshev UCL	530.1	95% KM Chebyshev UCL	699.7
97.5% KM Chebyshev UCL	935.2	99% KM Chebyshev UCL	1398

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.751	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.735	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.293	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.348	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.511	k star (bias corrected MLE)	0.367
Theta hat (MLE)	492.8	Theta star (bias corrected MLE)	686.9
nu hat (MLE)	6.133	nu star (bias corrected)	4.4
Mean (detects)	251.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	151.1
Maximum	1230	Median	21
SD	381.6	CV	2.526
k hat (MLE)	0.175	k star (bias corrected MLE)	0.189
Theta hat (MLE)	862.3	Theta star (bias corrected MLE)	798.1
nu hat (MLE)	3.505	nu star (bias corrected)	3.787
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (3.79, α)	0.639	Adjusted Chi Square Value (3.79, β)	0.454
95% Gamma Approximate UCL (use when n>=50)	895.1	95% Gamma Adjusted UCL (use when n<50)	1260

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	155.6	SD (KM)	360.3
Variance (KM)	129811	SE of Mean (KM)	124.8
k hat (KM)	0.187	k star (KM)	0.197
nu hat (KM)	3.731	nu star (KM)	3.945
theta hat (KM)	834.2	theta star (KM)	788.9
80% gamma percentile (KM)	203.6	90% gamma percentile (KM)	470.6
95% gamma percentile (KM)	804.7	99% gamma percentile (KM)	1727

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.95, α)	0.7	Adjusted Chi Square Value (3.95, β)	0.502
95% Gamma Approximate KM-UCL (use when n>=50)	876.9	95% Gamma Adjusted KM-UCL (use when n<50)	1224

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.221	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	152.8	Mean in Log Scale	3.021
SD in Original Scale	380.9	SD in Log Scale	2.073
95% t UCL (assumes normality of ROS data)	373.6	95% Percentile Bootstrap UCL	390.5
95% BCA Bootstrap UCL	509.2	95% Bootstrap t UCL	2611
95% H-UCL (Log ROS)	8255		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.451	KM Geo Mean	31.54
KM SD (logged)	1.554	95% Critical H Value (KM-Log)	4.333
KM Standard Error of Mean (logged)	0.547	95% H-UCL (KM -Log)	997
KM SD (logged)	1.554	95% Critical H Value (KM-Log)	4.333
KM Standard Error of Mean (logged)	0.547		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	157.9	Mean in Log Scale	3.406
SD in Original Scale	379	SD in Log Scale	1.8
95% t UCL (Assumes normality)	377.6	95% H-Stat UCL	2907

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	2354	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	1224

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	9	Number of Non-Detects	1
Number of Distinct Detects	9	Number of Distinct Non-Detects	1
Minimum Detect	29	Minimum Non-Detect	10
Maximum Detect	4150	Maximum Non-Detect	10
Variance Detects	1796555	Percent Non-Detects	10%
Mean Detects	594.4	SD Detects	1340
Median Detects	84	CV Detects	2.255
Skewness Detects	2.942	Kurtosis Detects	8.73
Mean of Logged Detects	5.032	SD of Logged Detects	1.521

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.473	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.429	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	536	KM Standard Error of Mean	406.4
KM SD	1212	95% KM (BCA) UCL	1326
95% KM (t) UCL	1281	95% KM (Percentile Bootstrap) UCL	1324
95% KM (z) UCL	1204	95% KM Bootstrap t UCL	7604
90% KM Chebyshev UCL	1755	95% KM Chebyshev UCL	2307
97.5% KM Chebyshev UCL	3074	99% KM Chebyshev UCL	4579

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.091	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.776	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.292	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.473	k star (bias corrected MLE)	0.389
Theta hat (MLE)	1258	Theta star (bias corrected MLE)	1527
nu hat (MLE)	8.508	nu star (bias corrected)	7.005
Mean (detects)	594.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	535
Maximum	4150	Median	81.75
SD	1278	CV	2.388
k hat (MLE)	0.31	k star (bias corrected MLE)	0.284
Theta hat (MLE)	1727	Theta star (bias corrected MLE)	1887
nu hat (MLE)	6.196	nu star (bias corrected)	5.671
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (5.67, α)	1.474	Adjusted Chi Square Value (5.67, β)	1.136
95% Gamma Approximate UCL (use when n>=50)	2058	95% Gamma Adjusted UCL (use when n<50)	2670

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	536	SD (KM)	1212
Variance (KM)	1467980	SE of Mean (KM)	406.4
k hat (KM)	0.196	k star (KM)	0.204
nu hat (KM)	3.913	nu star (KM)	4.073
theta hat (KM)	2739	theta star (KM)	2632
80% gamma percentile (KM)	712.8	90% gamma percentile (KM)	1621
95% gamma percentile (KM)	2749	99% gamma percentile (KM)	5844

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.07, α)	0.751	Adjusted Chi Square Value (4.07, β)	0.541
95% Gamma Approximate KM-UCL (use when n>=50)	2908	95% Gamma Adjusted KM-UCL (use when n<50)	4032

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.209	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	535.4	Mean in Log Scale	4.669
SD in Original Scale	1277	SD in Log Scale	1.836
95% t UCL (assumes normality of ROS data)	1276	95% Percentile Bootstrap UCL	1317
95% BCA Bootstrap UCL	1767	95% Bootstrap t UCL	7346
95% H-UCL (Log ROS)	12291		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.759	KM Geo Mean	116.6
KM SD (logged)	1.588	95% Critical H Value (KM-Log)	4.411
KM Standard Error of Mean (logged)	0.533	95% H-UCL (KM -Log)	4248
KM SD (logged)	1.588	95% Critical H Value (KM-Log)	4.411
KM Standard Error of Mean (logged)	0.533		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	535.5	Mean in Log Scale	4.69
SD in Original Scale	1277	SD in Log Scale	1.797
95% t UCL (Assumes normality)	1276	95% H-Stat UCL	10315

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	7604	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	4032

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Minimum	2800	Mean	7045
Maximum	12500	Median	6625
SD	2779	Std. Error of Mean	878.8
Coefficient of Variation	0.394	Skewness	0.605

Normal GOF Test

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8656	95% Adjusted-CLT UCL (Chen-1995)	8670
		95% Modified-t UCL (Johnson-1978)	8684

Gamma GOF Test

A-D Test Statistic	0.188	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.153	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.869	k star (bias corrected MLE)	4.875
Theta hat (MLE)	1026	Theta star (bias corrected MLE)	1445
nu hat (MLE)	137.4	nu star (bias corrected)	97.5
MLE Mean (bias corrected)	7045	MLE Sd (bias corrected)	3191
		Approximate Chi Square Value (0.05)	75.72
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	72.39

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	9071	95% Adjusted Gamma UCL (use when n<50)	9488

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.937	Mean of logged Data	8.786
Maximum of Logged Data	9.433	SD of logged Data	0.42

Assuming Lognormal Distribution

95% H-UCL	9602	90% Chebyshev (MVUE) UCL	9932
95% Chebyshev (MVUE) UCL	11226	97.5% Chebyshev (MVUE) UCL	13022
99% Chebyshev (MVUE) UCL	16550		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	8490	95% Jackknife UCL	8656
95% Standard Bootstrap UCL	8415	95% Bootstrap-t UCL	9022
95% Hall's Bootstrap UCL	9406	95% Percentile Bootstrap UCL	8450
95% BCA Bootstrap UCL	8455		
90% Chebyshev(Mean, Sd) UCL	9681	95% Chebyshev(Mean, Sd) UCL	10875
97.5% Chebyshev(Mean, Sd) UCL	12533	99% Chebyshev(Mean, Sd) UCL	15789

Suggested UCL to Use

95% Student's-t UCL	8656

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	0.29	Mean	3.471
Maximum	12	Median	2.25
SD	3.755	Std. Error of Mean	1.187
Coefficient of Variation	1.082	Skewness	1.44

Normal GOF Test

Shapiro Wilk Test Statistic	0.836	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.218	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.648	95% Adjusted-CLT UCL (Chen-1995)	6.002
		95% Modified-t UCL (Johnson-1978)	5.738

Gamma GOF Test

A-D Test Statistic	0.305	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.162	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.275	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.886	k star (bias corrected MLE)	0.687
Theta hat (MLE)	3.918	Theta star (bias corrected MLE)	5.054
nu hat (MLE)	17.72	nu star (bias corrected)	13.74
MLE Mean (bias corrected)	3.471	MLE Sd (bias corrected)	4.188
		Approximate Chi Square Value (0.05)	6.391
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	5.544

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7.46	95% Adjusted Gamma UCL (use when n<50)	8.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.169	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.238	Mean of logged Data	0.583
Maximum of Logged Data	2.485	SD of logged Data	1.327

Assuming Lognormal Distribution

95% H-UCL	23.33	90% Chebyshev (MVUE) UCL	8.783
95% Chebyshev (MVUE) UCL	11.06	97.5% Chebyshev (MVUE) UCL	14.21
99% Chebyshev (MVUE) UCL	20.4		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.424	95% Jackknife UCL	5.648
95% Standard Bootstrap UCL	5.352	95% Bootstrap-t UCL	6.985
95% Hall's Bootstrap UCL	7.947	95% Percentile Bootstrap UCL	5.395
95% BCA Bootstrap UCL	6		
90% Chebyshev(Mean, Sd) UCL	7.033	95% Chebyshev(Mean, Sd) UCL	8.647
97.5% Chebyshev(Mean, Sd) UCL	10.89	99% Chebyshev(Mean, Sd) UCL	15.29

Suggested UCL to Use

95% Student's-t UCL	5.648

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	4.7	Mean	13.79
Maximum	26.5	Median	10.88
SD	7.453	Std. Error of Mean	2.357
Coefficient of Variation	0.541	Skewness	0.633

Normal GOF Test

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.246	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	18.11	95% Adjusted-CLT UCL (Chen-1995)	18.17
		95% Modified-t UCL (Johnson-1978)	18.18

Gamma GOF Test

A-D Test Statistic	0.284	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.197	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.762	k star (bias corrected MLE)	2.7
Theta hat (MLE)	3.664	Theta star (bias corrected MLE)	5.105
nu hat (MLE)	75.24	nu star (bias corrected)	54
MLE Mean (bias corrected)	13.79	MLE Sd (bias corrected)	8.389
		Approximate Chi Square Value (0.05)	38.12
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	35.81

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	19.53	95% Adjusted Gamma UCL (use when n<50)	20.79

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.956	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.548	Mean of logged Data	2.485
Maximum of Logged Data	3.277	SD of logged Data	0.568

Assuming Lognormal Distribution

95% H-UCL	21.86	90% Chebyshev (MVUE) UCL	21.47
95% Chebyshev (MVUE) UCL	24.92	97.5% Chebyshev (MVUE) UCL	29.71
99% Chebyshev (MVUE) UCL	39.13		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	17.66	95% Jackknife UCL	18.11
95% Standard Bootstrap UCL	17.46	95% Bootstrap-t UCL	18.94
95% Hall's Bootstrap UCL	18.36	95% Percentile Bootstrap UCL	17.45
95% BCA Bootstrap UCL	18.12		
90% Chebyshev(Mean, Sd) UCL	20.86	95% Chebyshev(Mean, Sd) UCL	24.06
97.5% Chebyshev(Mean, Sd) UCL	28.5	99% Chebyshev(Mean, Sd) UCL	37.24

Suggested UCL to Use

95% Student's-t UCL	18.11

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	54	Mean	714.3
Maximum	2900	Median	450
SD	874.6	Std. Error of Mean	276.6
Coefficient of Variation	1.224	Skewness	1.97

Normal GOF Test

Shapiro Wilk Test Statistic	0.757	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1221	95% Adjusted-CLT UCL (Chen-1995)	1353
		95% Modified-t UCL (Johnson-1978)	1250

Gamma GOF Test

A-D Test Statistic	0.44	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.233	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.275	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.821	k star (bias corrected MLE)	0.641
Theta hat (MLE)	870	Theta star (bias corrected MLE)	1114
nu hat (MLE)	16.42	nu star (bias corrected)	12.83
MLE Mean (bias corrected)	714.3	MLE Sd (bias corrected)	891.9
		Approximate Chi Square Value (0.05)	5.777
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	4.979

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1586	95% Adjusted Gamma UCL (use when n<50)	1840

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.989	Mean of logged Data	5.851
Maximum of Logged Data	7.972	SD of logged Data	1.341

Assuming Lognormal Distribution

95% H-UCL	4752	90% Chebyshev (MVUE) UCL	1738
95% Chebyshev (MVUE) UCL	2190	97.5% Chebyshev (MVUE) UCL	2817
99% Chebyshev (MVUE) UCL	4048		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1169	95% Jackknife UCL	1221
95% Standard Bootstrap UCL	1136	95% Bootstrap-t UCL	1659
95% Hall's Bootstrap UCL	2996	95% Percentile Bootstrap UCL	1180
95% BCA Bootstrap UCL	1344		
90% Chebyshev(Mean, Sd) UCL	1544	95% Chebyshev(Mean, Sd) UCL	1920
97.5% Chebyshev(Mean, Sd) UCL	2441	99% Chebyshev(Mean, Sd) UCL	3466

Suggested UCL to Use

95% Student's-t UCL	1221

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	0.27	Mean	3.535
Maximum	16	Median	2.45
SD	4.692	Std. Error of Mean	1.484
Coefficient of Variation	1.327	Skewness	2.441

Normal GOF Test

Shapiro Wilk Test Statistic	0.683	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.294	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6.255	95% Adjusted-CLT UCL (Chen-1995)	7.2
		95% Modified-t UCL (Johnson-1978)	6.446

Gamma GOF Test

A-D Test Statistic	0.406	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.755	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.156	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.275	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.805	k star (bias corrected MLE)	0.63
Theta hat (MLE)	4.393	Theta star (bias corrected MLE)	5.611
nu hat (MLE)	16.09	nu star (bias corrected)	12.6
MLE Mean (bias corrected)	3.535	MLE Sd (bias corrected)	4.454
		Approximate Chi Square Value (0.05)	5.624
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	4.839

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	7.919	95% Adjusted Gamma UCL (use when n<50)	9.204

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.309	Mean of logged Data	0.526
Maximum of Logged Data	2.773	SD of logged Data	1.365

Assuming Lognormal Distribution

95% H-UCL	25.28	90% Chebyshev (MVUE) UCL	8.775
95% Chebyshev (MVUE) UCL	11.07	97.5% Chebyshev (MVUE) UCL	14.26
99% Chebyshev (MVUE) UCL	20.52		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.976	95% Jackknife UCL	6.255
95% Standard Bootstrap UCL	5.804	95% Bootstrap-t UCL	9.692
95% Hall's Bootstrap UCL	15.57	95% Percentile Bootstrap UCL	6.158
95% BCA Bootstrap UCL	7.485		
90% Chebyshev(Mean, Sd) UCL	7.987	95% Chebyshev(Mean, Sd) UCL	10
97.5% Chebyshev(Mean, Sd) UCL	12.8	99% Chebyshev(Mean, Sd) UCL	18.3

Suggested UCL to Use

95% Adjusted Gamma UCL	9.204

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	6	Number of Non-Detects	4
Number of Distinct Detects	6	Number of Distinct Non-Detects	3
Minimum Detect	0.74	Minimum Non-Detect	0.25
Maximum Detect	6	Maximum Non-Detect	1.5
Variance Detects	4.425	Percent Non-Detects	40%
Mean Detects	1.71	SD Detects	2.104
Median Detects	0.88	CV Detects	1.23
Skewness Detects	2.439	Kurtosis Detects	5.961
Mean of Logged Detects	0.161	SD of Logged Detects	0.806

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.537	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.467	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.277	KM Standard Error of Mean	0.554
KM SD	1.591	95% KM (BCA) UCL	2.338
95% KM (t) UCL	2.292	95% KM (Percentile Bootstrap) UCL	2.269
95% KM (z) UCL	2.187	95% KM Bootstrap t UCL	8.413
90% KM Chebyshev UCL	2.938	95% KM Chebyshev UCL	3.691
97.5% KM Chebyshev UCL	4.735	99% KM Chebyshev UCL	6.787

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.373	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.708	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.459	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.338	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.474	k star (bias corrected MLE)	0.848
Theta hat (MLE)	1.16	Theta star (bias corrected MLE)	2.016
nu hat (MLE)	17.69	nu star (bias corrected)	10.18
Mean (detects)	1.71		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.208
Maximum	6	Median	0.815
SD	1.73	CV	1.432
k hat (MLE)	0.59	k star (bias corrected MLE)	0.48
Theta hat (MLE)	2.048	Theta star (bias corrected MLE)	2.519
nu hat (MLE)	11.8	nu star (bias corrected)	9.592
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (9.59, α)	3.689	Adjusted Chi Square Value (9.59, β)	3.08
95% Gamma Approximate UCL (use when n>=50)	3.141	95% Gamma Adjusted UCL (use when n<50)	3.762

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.277	SD (KM)	1.591
Variance (KM)	2.53	SE of Mean (KM)	0.554
k hat (KM)	0.644	k star (KM)	0.517
nu hat (KM)	12.88	nu star (KM)	10.35
theta hat (KM)	1.982	theta star (KM)	2.467
80% gamma percentile (KM)	2.099	90% gamma percentile (KM)	3.429
95% gamma percentile (KM)	4.844	99% gamma percentile (KM)	8.313

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.35, α)	4.161	Adjusted Chi Square Value (10.35, β)	3.505
95% Gamma Approximate KM-UCL (use when n>=50)	3.175	95% Gamma Adjusted KM-UCL (use when n<50)	3.768

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.621	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.417	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.293	Mean in Log Scale	-0.119
SD in Original Scale	1.671	SD in Log Scale	0.793
95% t UCL (assumes normality of ROS data)	2.262	95% Percentile Bootstrap UCL	2.305
95% BCA Bootstrap UCL	2.855	95% Bootstrap t UCL	6.708
95% H-UCL (Log ROS)	2.48		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.153	KM Geo Mean	0.858
KM SD (logged)	0.784	95% Critical H Value (KM-Log)	2.681
KM Standard Error of Mean (logged)	0.292	95% H-UCL (KM -Log)	2.351
KM SD (logged)	0.784	95% Critical H Value (KM-Log)	2.681
KM Standard Error of Mean (logged)	0.292		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.254	Mean in Log Scale	-0.212
SD in Original Scale	1.684	SD in Log Scale	0.921
95% t UCL (Assumes normality)	2.23	95% H-Stat UCL	3.048

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	3.691

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	3.2	Mean	11.28
Maximum	29	Median	8.775
SD	8.607	Std. Error of Mean	2.722
Coefficient of Variation	0.763	Skewness	1.37

Normal GOF Test

Shapiro Wilk Test Statistic	0.816	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.29	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	16.26	95% Adjusted-CLT UCL (Chen-1995)	17.01
		95% Modified-t UCL (Johnson-1978)	16.46

Gamma GOF Test

A-D Test Statistic	0.444	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.2	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.27	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.227	k star (bias corrected MLE)	1.626
Theta hat (MLE)	5.062	Theta star (bias corrected MLE)	6.935
nu hat (MLE)	44.55	nu star (bias corrected)	32.52
MLE Mean (bias corrected)	11.28	MLE Sd (bias corrected)	8.843
		Approximate Chi Square Value (0.05)	20.48
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	18.84

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	17.9	95% Adjusted Gamma UCL (use when n<50)	19.46

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.171	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.163	Mean of logged Data	2.182
Maximum of Logged Data	3.367	SD of logged Data	0.729

Assuming Lognormal Distribution

95% H-UCL	21.66	90% Chebyshev (MVUE) UCL	19.2
95% Chebyshev (MVUE) UCL	22.83	97.5% Chebyshev (MVUE) UCL	27.86
99% Chebyshev (MVUE) UCL	37.74		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	15.75	95% Jackknife UCL	16.26
95% Standard Bootstrap UCL	15.51	95% Bootstrap-t UCL	21.82
95% Hall's Bootstrap UCL	48.12	95% Percentile Bootstrap UCL	15.78
95% BCA Bootstrap UCL	16.84		
90% Chebyshev(Mean, Sd) UCL	19.44	95% Chebyshev(Mean, Sd) UCL	23.14
97.5% Chebyshev(Mean, Sd) UCL	28.27	99% Chebyshev(Mean, Sd) UCL	38.36

Suggested UCL to Use

95% Adjusted Gamma UCL	19.46

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	17	Mean	577.9
Maximum	2900	Median	310
SD	874.9	Std. Error of Mean	276.7
Coefficient of Variation	1.514	Skewness	2.443

Normal GOF Test

Shapiro Wilk Test Statistic	0.668	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1085	95% Adjusted-CLT UCL (Chen-1995)	1261
		95% Modified-t UCL (Johnson-1978)	1121

Gamma GOF Test

A-D Test Statistic	0.503	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.774	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.219	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.533	k star (bias corrected MLE)	0.44
Theta hat (MLE)	1084	Theta star (bias corrected MLE)	1314
nu hat (MLE)	10.66	nu star (bias corrected)	8.797
MLE Mean (bias corrected)	577.9	MLE Sd (bias corrected)	871.3
		Approximate Chi Square Value (0.05)	3.205
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.646

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1586	95% Adjusted Gamma UCL (use when n<50)	1921

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.212	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.833	Mean of logged Data	5.18
Maximum of Logged Data	7.972	SD of logged Data	1.818

Assuming Lognormal Distribution

95% H-UCL	18721	90% Chebyshev (MVUE) UCL	1881
95% Chebyshev (MVUE) UCL	2428	97.5% Chebyshev (MVUE) UCL	3188
99% Chebyshev (MVUE) UCL	4680		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1033	95% Jackknife UCL	1085
95% Standard Bootstrap UCL	1006	95% Bootstrap-t UCL	1703
95% Hall's Bootstrap UCL	2732	95% Percentile Bootstrap UCL	1045
95% BCA Bootstrap UCL	1279		
90% Chebyshev(Mean, Sd) UCL	1408	95% Chebyshev(Mean, Sd) UCL	1784
97.5% Chebyshev(Mean, Sd) UCL	2306	99% Chebyshev(Mean, Sd) UCL	3331

Suggested UCL to Use

95% Adjusted Gamma UCL	1921

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	3	Number of Non-Detects	7
Number of Distinct Detects	3	Number of Distinct Non-Detects	6
Minimum Detect	0.62	Minimum Non-Detect	0.2
Maximum Detect	41	Maximum Non-Detect	2.8
Variance Detects	475.9	Percent Non-Detects	70%
Mean Detects	16.04	SD Detects	21.82
Median Detects	6.5	CV Detects	1.36
Skewness Detects	1.592	Kurtosis Detects	N/A
Mean of Logged Detects	1.702	SD of Logged Detects	2.101

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.958	KM Standard Error of Mean	4.709
KM SD	12.16	95% KM (BCA) UCL	N/A
95% KM (t) UCL	13.59	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	12.7	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	19.08	95% KM Chebyshev UCL	25.48
97.5% KM Chebyshev UCL	34.36	99% KM Chebyshev UCL	51.81

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.579	k star (bias corrected MLE)	N/A
Theta hat (MLE)	27.7	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.474	nu star (bias corrected)	N/A
Mean (detects)	16.04		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4.819
Maximum	41	Median	0.01
SD	12.87	CV	2.671
k hat (MLE)	0.175	k star (bias corrected MLE)	0.189
Theta hat (MLE)	27.5	Theta star (bias corrected MLE)	25.45
nu hat (MLE)	3.505	nu star (bias corrected)	3.787
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (3.79, α)	0.639	Adjusted Chi Square Value (3.79, β)	0.454
95% Gamma Approximate UCL (use when n>=50)	28.54	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.958	SD (KM)	12.16
Variance (KM)	147.8	SE of Mean (KM)	4.709
k hat (KM)	0.166	k star (KM)	0.183
nu hat (KM)	3.326	nu star (KM)	3.662
theta hat (KM)	29.81	theta star (KM)	27.08
80% gamma percentile (KM)	6.215	90% gamma percentile (KM)	14.96
95% gamma percentile (KM)	26.12	99% gamma percentile (KM)	57.3

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.66, α)	0.593	Adjusted Chi Square Value (3.66, β)	0.418
95% Gamma Approximate KM-UCL (use when n>=50)	30.63	95% Gamma Adjusted KM-UCL (use when n<50)	43.39

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.995	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.199	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.816	Mean in Log Scale	-3.408
SD in Original Scale	12.87	SD in Log Scale	3.745
95% t UCL (assumes normality of ROS data)	12.28	95% Percentile Bootstrap UCL	12.43
95% BCA Bootstrap UCL	20.56	95% Bootstrap t UCL	319.4
95% H-UCL (Log ROS)	6996829		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.6	KM Geo Mean	0.549
KM SD (logged)	1.781	95% Critical H Value (KM-Log)	4.869
KM Standard Error of Mean (logged)	0.692	95% H-UCL (KM -Log)	48.27
KM SD (logged)	1.781	95% Critical H Value (KM-Log)	4.869
KM Standard Error of Mean (logged)	0.692		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.03	Mean in Log Scale	-0.717
SD in Original Scale	12.79	SD in Log Scale	2.098
95% t UCL (Assumes normality)	12.45	95% H-Stat UCL	226.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	13.59

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	8800	Mean	36500
Maximum	110000	Median	24500
SD	37063	Std. Error of Mean	11720
Coefficient of Variation	1.015	Skewness	1.592

Normal GOF Test

Shapiro Wilk Test Statistic	0.713	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.343	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	57985	95% Adjusted-CLT UCL (Chen-1995)	62084
		95% Modified-t UCL (Johnson-1978)	58969

Gamma GOF Test

A-D Test Statistic	0.695	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.242	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.271	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.453	k star (bias corrected MLE)	1.084
Theta hat (MLE)	25123	Theta star (bias corrected MLE)	33682
nu hat (MLE)	29.06	nu star (bias corrected)	21.67
MLE Mean (bias corrected)	36500	MLE Sd (bias corrected)	35063
		Approximate Chi Square Value (0.05)	12.09
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	10.87

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	65412	95% Adjusted Gamma UCL (use when n<50)	72780

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.083	Mean of logged Data	10.12
Maximum of Logged Data	11.61	SD of logged Data	0.881

Assuming Lognormal Distribution

95% H-UCL	85260	90% Chebyshev (MVUE) UCL	65454
95% Chebyshev (MVUE) UCL	79262	97.5% Chebyshev (MVUE) UCL	98426
99% Chebyshev (MVUE) UCL	136072		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	55778	95% Jackknife UCL	57985
95% Standard Bootstrap UCL	54908	95% Bootstrap-t UCL	114402
95% Hall's Bootstrap UCL	194689	95% Percentile Bootstrap UCL	55800
95% BCA Bootstrap UCL	61770		
90% Chebyshev(Mean, Sd) UCL	71661	95% Chebyshev(Mean, Sd) UCL	87588
97.5% Chebyshev(Mean, Sd) UCL	109694	99% Chebyshev(Mean, Sd) UCL	153117

Suggested UCL to Use

95% Adjusted Gamma UCL	72780

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	15	Mean	601.4
Maximum	2200	Median	355
SD	764.5	Std. Error of Mean	241.7
Coefficient of Variation	1.271	Skewness	1.464

Normal GOF Test

Shapiro Wilk Test Statistic	0.779	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.248	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1044	95% Adjusted-CLT UCL (Chen-1995)	1119
		95% Modified-t UCL (Johnson-1978)	1063

Gamma GOF Test

A-D Test Statistic	0.333	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.772	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.177	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.28	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.561	k star (bias corrected MLE)	0.46
Theta hat (MLE)	1071	Theta star (bias corrected MLE)	1308
nu hat (MLE)	11.23	nu star (bias corrected)	9.193
MLE Mean (bias corrected)	601.4	MLE Sd (bias corrected)	887
		Approximate Chi Square Value (0.05)	3.444
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	2.86

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1605	95% Adjusted Gamma UCL (use when n<50)	1933

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.708	Mean of logged Data	5.288
Maximum of Logged Data	7.696	SD of logged Data	1.865

Assuming Lognormal Distribution

95% H-UCL	26374	90% Chebyshev (MVUE) UCL	2264
95% Chebyshev (MVUE) UCL	2929	97.5% Chebyshev (MVUE) UCL	3850
99% Chebyshev (MVUE) UCL	5661		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	999	95% Jackknife UCL	1044
95% Standard Bootstrap UCL	981.2	95% Bootstrap-t UCL	1578
95% Hall's Bootstrap UCL	3240	95% Percentile Bootstrap UCL	1009
95% BCA Bootstrap UCL	1086		
90% Chebyshev(Mean, Sd) UCL	1327	95% Chebyshev(Mean, Sd) UCL	1655
97.5% Chebyshev(Mean, Sd) UCL	2111	99% Chebyshev(Mean, Sd) UCL	3007

Suggested UCL to Use

95% Student's-t UCL	1044

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	3	Number of Distinct Observations	3
		Number of Missing Observations	9
Minimum	18	Mean	1206
Maximum	2000	Median	1600
SD	1048	Std. Error of Mean	605.1
Coefficient of Variation	0.869	Skewness	-1.453

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.313	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2973	95% Adjusted-CLT UCL (Chen-1995)	1659
		95% Modified-t UCL (Johnson-1978)	2888

Gamma GOF Test

Not Enough Data to Perform GOF Test

Gamma Statistics

k hat (MLE)	0.55	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2194	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.298	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
		Approximate Chi Square Value (0.05)	N/A
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	N/A	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.37	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.89	Mean of logged Data	5.956
Maximum of Logged Data	7.601	SD of logged Data	2.658

Assuming Lognormal Distribution

95% H-UCL	3.034E+32	90% Chebyshev (MVUE) UCL	7362
95% Chebyshev (MVUE) UCL	9794	97.5% Chebyshev (MVUE) UCL	13169
99% Chebyshev (MVUE) UCL	19800		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2201	95% Jackknife UCL	2973
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	3021	95% Chebyshev(Mean, Sd) UCL	3844
97.5% Chebyshev(Mean, Sd) UCL	4985	99% Chebyshev(Mean, Sd) UCL	7227

Suggested UCL to Use

95% Student's-t UCL	2973

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction

General Statistics

Total Number of Observations	3	Number of Distinct Observations	3
		Number of Missing Observations	9
Minimum	26	Mean	1575
Maximum	2700	Median	2000
SD	1387	Std. Error of Mean	800.6
Coefficient of Variation	0.88	Skewness	-1.249

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.287	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3913	95% Adjusted-CLT UCL (Chen-1995)	2275
		95% Modified-t UCL (Johnson-1978)	3817

Gamma GOF Test

Not Enough Data to Perform GOF Test

Gamma Statistics

k hat (MLE)	0.563	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2800	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.375	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
		Approximate Chi Square Value (0.05)	N/A
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	N/A	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.365	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.258	Mean of logged Data	6.253
Maximum of Logged Data	7.901	SD of logged Data	2.598

Assuming Lognormal Distribution

95% H-UCL	1.959E+31	90% Chebyshev (MVUE) UCL	9325
95% Chebyshev (MVUE) UCL	12399	97.5% Chebyshev (MVUE) UCL	16667
99% Chebyshev (MVUE) UCL	25049		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2892	95% Jackknife UCL	3913
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	3977	95% Chebyshev(Mean, Sd) UCL	5065
97.5% Chebyshev(Mean, Sd) UCL	6575	99% Chebyshev(Mean, Sd) UCL	9541

Suggested UCL to Use

95% Student's-t UCL	3913

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	3	Number of Distinct Observations	3
		Number of Missing Observations	9
Minimum	19	Mean	1306
Maximum	2200	Median	1700
SD	1143	Std. Error of Mean	659.7
Coefficient of Variation	0.875	Skewness	-1.366

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3233	95% Adjusted-CLT UCL (Chen-1995)	1835
		95% Modified-t UCL (Johnson-1978)	3146

Gamma GOF Test
Not Enough Data to Perform GOF Test

Gamma Statistics

k hat (MLE)	0.546	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2394	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.274	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
		Approximate Chi Square Value (0.05)	N/A
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	N/A	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.791	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.368	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.944	Mean of logged Data	6.026
Maximum of Logged Data	7.696	SD of logged Data	2.672

Assuming Lognormal Distribution

95% H-UCL	6.935E+32	90% Chebyshev (MVUE) UCL	8014
95% Chebyshev (MVUE) UCL	10663	97.5% Chebyshev (MVUE) UCL	14339
99% Chebyshev (MVUE) UCL	21560		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2391	95% Jackknife UCL	3233
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	3285	95% Chebyshev(Mean, Sd) UCL	4182
97.5% Chebyshev(Mean, Sd) UCL	5426	99% Chebyshev(Mean, Sd) UCL	7870

Suggested UCL to Use

95% Student's-t UCL	3233

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	34	Mean	487.9
Maximum	1100	Median	397.5
SD	300.2	Std. Error of Mean	94.93
Coefficient of Variation	0.615	Skewness	0.854

Normal GOF Test

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.25	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	661.9	95% Adjusted-CLT UCL (Chen-1995)	671.4
		95% Modified-t UCL (Johnson-1978)	666.2

Gamma GOF Test

A-D Test Statistic	0.603	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.735	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.273	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.27	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.059	k star (bias corrected MLE)	1.508
Theta hat (MLE)	237	Theta star (bias corrected MLE)	323.5
nu hat (MLE)	41.18	nu star (bias corrected)	30.16
MLE Mean (bias corrected)	487.9	MLE Sd (bias corrected)	397.3
		Approximate Chi Square Value (0.05)	18.62
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	17.06

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	790.3	95% Adjusted Gamma UCL (use when n<50)	862.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.775	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.333	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.526	Mean of logged Data	5.928
Maximum of Logged Data	7.003	SD of logged Data	0.94

Assuming Lognormal Distribution

95% H-UCL	1486	90% Chebyshev (MVUE) UCL	1065
95% Chebyshev (MVUE) UCL	1298	97.5% Chebyshev (MVUE) UCL	1621
99% Chebyshev (MVUE) UCL	2256		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	644.1	95% Jackknife UCL	661.9
95% Standard Bootstrap UCL	634.5	95% Bootstrap-t UCL	734.8
95% Hall's Bootstrap UCL	859.1	95% Percentile Bootstrap UCL	636.4
95% BCA Bootstrap UCL	654.5		
90% Chebyshev(Mean, Sd) UCL	772.7	95% Chebyshev(Mean, Sd) UCL	901.7
97.5% Chebyshev(Mean, Sd) UCL	1081	99% Chebyshev(Mean, Sd) UCL	1432

Suggested UCL to Use

95% Student's-t UCL	661.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	9	Number of Non-Detects	1
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	0.021	Minimum Non-Detect	0.019
Maximum Detect	3.2	Maximum Non-Detect	0.019
Variance Detects	1.011	Percent Non-Detects	10%
Mean Detects	0.564	SD Detects	1.005
Median Detects	0.22	CV Detects	1.784
Skewness Detects	2.82	Kurtosis Detects	8.152
Mean of Logged Detects	-1.505	SD of Logged Detects	1.421

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.542	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.389	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.509	KM Standard Error of Mean	0.307
KM SD	0.914	95% KM (BCA) UCL	1.069
95% KM (t) UCL	1.071	95% KM (Percentile Bootstrap) UCL	1.07
95% KM (z) UCL	1.013	95% KM Bootstrap t UCL	3.932
90% KM Chebyshev UCL	1.429	95% KM Chebyshev UCL	1.845
97.5% KM Chebyshev UCL	2.424	99% KM Chebyshev UCL	3.559

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.731	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.759	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.308	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.291	Detected Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.655	k star (bias corrected MLE)	0.511
Theta hat (MLE)	0.861	Theta star (bias corrected MLE)	1.104
nu hat (MLE)	11.79	nu star (bias corrected)	9.191
Mean (detects)	0.564		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.508
Maximum	3.2	Median	0.205
SD	0.964	CV	1.897
k hat (MLE)	0.55	k star (bias corrected MLE)	0.452
Theta hat (MLE)	0.924	Theta star (bias corrected MLE)	1.125
nu hat (MLE)	11	nu star (bias corrected)	9.032
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (9.03, α)	3.346	Adjusted Chi Square Value (9.03, β)	2.773
95% Gamma Approximate UCL (use when n>=50)	1.372	95% Gamma Adjusted UCL (use when n<50)	1.655

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.509	SD (KM)	0.914
Variance (KM)	0.835	SE of Mean (KM)	0.307
k hat (KM)	0.31	k star (KM)	0.284
nu hat (KM)	6.205	nu star (KM)	5.677
theta hat (KM)	1.641	theta star (KM)	1.794
80% gamma percentile (KM)	0.77	90% gamma percentile (KM)	1.511
95% gamma percentile (KM)	2.37	99% gamma percentile (KM)	4.619

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.68, α)	1.477	Adjusted Chi Square Value (5.68, β)	1.139
95% Gamma Approximate KM-UCL (use when n>=50)	1.957	95% Gamma Adjusted KM-UCL (use when n<50)	2.538

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.234	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.508	Mean in Log Scale	-1.844
SD in Original Scale	0.964	SD in Log Scale	1.715
95% t UCL (assumes normality of ROS data)	1.067	95% Percentile Bootstrap UCL	1.062
95% BCA Bootstrap UCL	1.408	95% Bootstrap t UCL	3.958
95% H-UCL (Log ROS)	10.16		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.751	KM Geo Mean	0.174
KM SD (logged)	1.47	95% Critical H Value (KM-Log)	4.136
KM Standard Error of Mean (logged)	0.493	95% H-UCL (KM -Log)	3.876
KM SD (logged)	1.47	95% Critical H Value (KM-Log)	4.136
KM Standard Error of Mean (logged)	0.493		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.508	Mean in Log Scale	-1.82
SD in Original Scale	0.964	SD in Log Scale	1.67
95% t UCL (Assumes normality)	1.067	95% H-Stat UCL	8.471

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	3.932	Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	2.538

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	0.075	Mean	0.261
Maximum	0.65	Median	0.24
SD	0.167	Std. Error of Mean	0.0527
Coefficient of Variation	0.639	Skewness	1.416

Normal GOF Test

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.196	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.357	95% Adjusted-CLT UCL (Chen-1995)	0.372
		95% Modified-t UCL (Johnson-1978)	0.361

Gamma GOF Test

A-D Test Statistic	0.236	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.137	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.269	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.93	k star (bias corrected MLE)	2.118
Theta hat (MLE)	0.0889	Theta star (bias corrected MLE)	0.123
nu hat (MLE)	58.61	nu star (bias corrected)	42.36
MLE Mean (bias corrected)	0.261	MLE Sd (bias corrected)	0.179
		Approximate Chi Square Value (0.05)	28.44
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	26.47

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.388	95% Adjusted Gamma UCL (use when n<50)	0.417

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.59	Mean of logged Data	-1.525
Maximum of Logged Data	-0.431	SD of logged Data	0.649

Assuming Lognormal Distribution

95% H-UCL	0.456	90% Chebyshev (MVUE) UCL	0.428
95% Chebyshev (MVUE) UCL	0.503	97.5% Chebyshev (MVUE) UCL	0.607
99% Chebyshev (MVUE) UCL	0.812		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.347	95% Jackknife UCL	0.357
95% Standard Bootstrap UCL	0.344	95% Bootstrap-t UCL	0.399
95% Hall's Bootstrap UCL	0.73	95% Percentile Bootstrap UCL	0.348
95% BCA Bootstrap UCL	0.376		
90% Chebyshev(Mean, Sd) UCL	0.419	95% Chebyshev(Mean, Sd) UCL	0.49
97.5% Chebyshev(Mean, Sd) UCL	0.59	99% Chebyshev(Mean, Sd) UCL	0.785

Suggested UCL to Use

95% Student's-t UCL	0.357

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Minimum	10	Mean	23
Maximum	50	Median	18.5
SD	11.86	Std. Error of Mean	3.751
Coefficient of Variation	0.516	Skewness	1.347

Normal GOF Test

Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	29.88	95% Adjusted-CLT UCL (Chen-1995)	30.88
		95% Modified-t UCL (Johnson-1978)	30.14

Gamma GOF Test

A-D Test Statistic	0.347	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.729	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.268	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.794	k star (bias corrected MLE)	3.423
Theta hat (MLE)	4.797	Theta star (bias corrected MLE)	6.72
nu hat (MLE)	95.88	nu star (bias corrected)	68.45
MLE Mean (bias corrected)	23	MLE Sd (bias corrected)	12.43
		Approximate Chi Square Value (0.05)	50.41
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	47.73

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	31.23	95% Adjusted Gamma UCL (use when n<50)	32.99

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.303	Mean of logged Data	3.028
Maximum of Logged Data	3.912	SD of logged Data	0.483

Assuming Lognormal Distribution

95% H-UCL	33.05	90% Chebyshev (MVUE) UCL	33.59
95% Chebyshev (MVUE) UCL	38.43	97.5% Chebyshev (MVUE) UCL	45.14
99% Chebyshev (MVUE) UCL	58.33		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	29.17	95% Jackknife UCL	29.88
95% Standard Bootstrap UCL	28.92	95% Bootstrap-t UCL	32.4
95% Hall's Bootstrap UCL	34.1	95% Percentile Bootstrap UCL	29.2
95% BCA Bootstrap UCL	29.9		
90% Chebyshev(Mean, Sd) UCL	34.25	95% Chebyshev(Mean, Sd) UCL	39.35
97.5% Chebyshev(Mean, Sd) UCL	46.42	99% Chebyshev(Mean, Sd) UCL	60.32

Suggested UCL to Use

95% Student's-t UCL	29.88

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Minimum	45	Mean	1197
Maximum	5600	Median	860
SD	1643	Std. Error of Mean	519.4
Coefficient of Variation	1.372	Skewness	2.526

Normal GOF Test

Shapiro Wilk Test Statistic	0.673	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.303	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2149	95% Adjusted-CLT UCL (Chen-1995)	2495
		95% Modified-t UCL (Johnson-1978)	2218

Gamma GOF Test

A-D Test Statistic	0.421	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.762	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.175	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.277	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.688	k star (bias corrected MLE)	0.548
Theta hat (MLE)	1739	Theta star (bias corrected MLE)	2183
nu hat (MLE)	13.76	nu star (bias corrected)	10.97
MLE Mean (bias corrected)	1197	MLE Sd (bias corrected)	1617
		Approximate Chi Square Value (0.05)	4.556
Adjusted Level of Significance	0.0267	Adjusted Chi Square Value	3.863

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2882	95% Adjusted Gamma UCL (use when n<50)	3399

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.842	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.226	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.262	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.807	Mean of logged Data	6.207
Maximum of Logged Data	8.631	SD of logged Data	1.602

Assuming Lognormal Distribution

95% H-UCL	19252	90% Chebyshev (MVUE) UCL	3713
95% Chebyshev (MVUE) UCL	4748	97.5% Chebyshev (MVUE) UCL	6184
99% Chebyshev (MVUE) UCL	9006		

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2051	95% Jackknife UCL	2149
95% Standard Bootstrap UCL	1992	95% Bootstrap-t UCL	3369
95% Hall's Bootstrap UCL	5481	95% Percentile Bootstrap UCL	2145
95% BCA Bootstrap UCL	2563		
90% Chebyshev(Mean, Sd) UCL	2755	95% Chebyshev(Mean, Sd) UCL	3461
97.5% Chebyshev(Mean, Sd) UCL	4441	99% Chebyshev(Mean, Sd) UCL	6365

Suggested UCL to Use

95% Adjusted Gamma UCL	3399

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1232 (PCB-1232)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	1	Number of Non-Detects	9
Number of Distinct Detects	1	Number of Distinct Non-Detects	8

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1232 (PCB-1232) was not processed!

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	1	Number of Non-Detects	9
Number of Distinct Detects	1	Number of Distinct Non-Detects	8

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1242 (PCB-1242) was not processed!

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	1	Number of Non-Detects	9
Number of Distinct Detects	1	Number of Distinct Non-Detects	8

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1248 (PCB-1248) was not processed!

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	4	Number of Non-Detects	6
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	86	Minimum Non-Detect	22
Maximum Detect	1800	Maximum Non-Detect	32
Variance Detects	647422	Percent Non-Detects	60%
Mean Detects	611.5	SD Detects	804.6
Median Detects	280	CV Detects	1.316
Skewness Detects	1.826	Kurtosis Detects	3.347
Mean of Logged Detects	5.744	SD of Logged Detects	1.335

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.768	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.349	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	257.8	KM Standard Error of Mean	192.4
KM SD	526.9	95% KM (BCA) UCL	N/A
95% KM (t) UCL	610.5	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	574.3	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	835	95% KM Chebyshev UCL	1096
97.5% KM Chebyshev UCL	1459	99% KM Chebyshev UCL	2172

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.356	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.668	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.252	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.404	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.874	k star (bias corrected MLE)	0.385
Theta hat (MLE)	700	Theta star (bias corrected MLE)	1588
nu hat (MLE)	6.988	nu star (bias corrected)	3.08
Mean (detects)	611.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	244.6
Maximum	1800	Median	0.01
SD	561.7	CV	2.296
k hat (MLE)	0.131	k star (bias corrected MLE)	0.159
Theta hat (MLE)	1863	Theta star (bias corrected MLE)	1542
nu hat (MLE)	2.626	nu star (bias corrected)	3.172
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (3.17, α)	0.425	Adjusted Chi Square Value (3.17, β)	0.293
95% Gamma Approximate UCL (use when n>=50)	1825	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	257.8	SD (KM)	526.9
Variance (KM)	277629	SE of Mean (KM)	192.4
k hat (KM)	0.239	k star (KM)	0.234
nu hat (KM)	4.788	nu star (KM)	4.685
theta hat (KM)	1077	theta star (KM)	1101
80% gamma percentile (KM)	365.3	90% gamma percentile (KM)	776.9
95% gamma percentile (KM)	1272	99% gamma percentile (KM)	2602

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.68, α)	1.009	Adjusted Chi Square Value (4.68, β)	0.749
95% Gamma Approximate KM-UCL (use when n>=50)	1196	95% Gamma Adjusted KM-UCL (use when n<50)	1612

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.209	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	246.6	Mean in Log Scale	2.924
SD in Original Scale	560.8	SD in Log Scale	2.587
95% t UCL (assumes normality of ROS data)	571.6	95% Percentile Bootstrap UCL	566.8
95% BCA Bootstrap UCL	777.6	95% Bootstrap t UCL	2484
95% H-UCL (Log ROS)	192632		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.152	KM Geo Mean	63.58
KM SD (logged)	1.491	95% Critical H Value (KM-Log)	4.186
KM Standard Error of Mean (logged)	0.545	95% H-UCL (KM -Log)	1549
KM SD (logged)	1.491	95% Critical H Value (KM-Log)	4.186
KM Standard Error of Mean (logged)	0.545		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	252.5	Mean in Log Scale	3.839
SD in Original Scale	557.9	SD in Log Scale	1.815
95% t UCL (Assumes normality)	575.9	95% H-Stat UCL	4820

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	610.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260)

General Statistics

Total Number of Observations	10	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	3	Number of Non-Detects	7
Number of Distinct Detects	3	Number of Distinct Non-Detects	7
Minimum Detect	44	Minimum Non-Detect	22
Maximum Detect	770	Maximum Non-Detect	240
Variance Detects	150492	Percent Non-Detects	70%
Mean Detects	328	SD Detects	387.9
Median Detects	170	CV Detects	1.183
Skewness Detects	1.529	Kurtosis Detects	N/A
Mean of Logged Detects	5.189	SD of Logged Detects	1.432

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.325	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	116.3	KM Standard Error of Mean	86.47
KM SD	222.7	95% KM (BCA) UCL	N/A
95% KM (t) UCL	274.9	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	258.6	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	375.8	95% KM Chebyshev UCL	493.3
97.5% KM Chebyshev UCL	656.4	99% KM Chebyshev UCL	976.7

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.96	k star (bias corrected MLE)	N/A
Theta hat (MLE)	341.7	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	5.76	nu star (bias corrected)	N/A
Mean (detects)	328		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	98.41
Maximum	770	Median	0.01
SD	242	CV	2.459
k hat (MLE)	0.126	k star (bias corrected MLE)	0.155
Theta hat (MLE)	781.4	Theta star (bias corrected MLE)	635.6
nu hat (MLE)	2.519	nu star (bias corrected)	3.096
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (3.10, α)	0.402	Adjusted Chi Square Value (3.10, β)	0.276
95% Gamma Approximate UCL (use when n>=50)	758.9	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.13.2

Summary of ProUCL Output for EU15 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 3:57:47 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	116.3	SD (KM)	222.7
Variance (KM)	49579	SE of Mean (KM)	86.47
k hat (KM)	0.273	k star (KM)	0.258
nu hat (KM)	5.46	nu star (KM)	5.155
theta hat (KM)	426.2	theta star (KM)	451.3
80% gamma percentile (KM)	170.8	90% gamma percentile (KM)	348.4
95% gamma percentile (KM)	558	99% gamma percentile (KM)	1114

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.16, α)	1.225	Adjusted Chi Square Value (5.16, β)	0.927
95% Gamma Approximate KM-UCL (use when n>=50)	489.8	95% Gamma Adjusted KM-UCL (use when n<50)	647.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.999	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.181	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	101.1	Mean in Log Scale	2.455
SD in Original Scale	240.8	SD in Log Scale	2.023
95% t UCL (assumes normality of ROS data)	240.6	95% Percentile Bootstrap UCL	238
95% BCA Bootstrap UCL	322.3	95% Bootstrap t UCL	1858
95% H-UCL (Log ROS)	3558		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.768	KM Geo Mean	43.28
KM SD (logged)	1.157	95% Critical H Value (KM-Log)	3.435
KM Standard Error of Mean (logged)	0.459	95% H-UCL (KM -Log)	318.2
KM SD (logged)	1.157	95% Critical H Value (KM-Log)	3.435
KM Standard Error of Mean (logged)	0.459		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	123.9	Mean in Log Scale	3.741
SD in Original Scale	233.4	SD in Log Scale	1.444
95% t UCL (Assumes normality)	259.2	95% H-Stat UCL	851.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	274.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.3

Summary of ProUCL Input Data for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Ethylbenzene	D_Ethylbenzene	Trichloroethene	D_Trichloroethene	Xylenes (total)	D_Xylenes (total)	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS	350	0	350	0	4300	1	140	1				
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS	4.5	0	4.5	0	1.5	1	9	0				
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS												
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	0.685	0	1	0	0.625	0	1.55	0	135	1	115	1
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	15	0	20	0	850	1	38	0	180	1	140	1
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	0.615	0	69.5	0	3400	1	140	1	7050	1	6350	1
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS					3.7	1			200	1	220	1
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	5.3	1							4.6	0	13	0
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	12	0	16	0	3000	1	30	0	79	1	88	1
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	15	0	33	0	700	1	230	1	260	1	320	1
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	0.99	0	1.5	0	8.1	1	2.3	0	36	1	41	1
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	0.91	0	1.4	0	3.7	1	2.1	0	600	1	690	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	0.69	0	1	0	0.63	0	1.6	0	34	1	34	1
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS												
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU15)	BH54-13	6/18/2013	4-6 ft BGS	5.6	0	5.6	0	8.4	1	11	0				
on-site (EU15)	BH55-13	6/18/2013	2-4 ft BGS			260000	1			2000000	1				
on-site (EU15)	BH59-13	6/19/2013	2-4 ft BGS	430	0	430	0	2500	1	860	1				
on-site (EU15)	BH143-18	1/23/2018	10-12 ft BGS	0.56	0	0.455	0	0.695	0	0.675	0	237.5	1	490	1
on-site (EU15)	BH144-18	1/22/2018	14.5-16.5 ft BGS	0.31	0	0.25	0	0.38	0	0.37	0	11	1	15	1
on-site (EU15)	BH145-18	1/22/2018	9-11 ft BGS	0.3	0	0.24	0	0.64	1	0.36	0	0.73	0	0.75	0
on-site (EU15)	GP19-18	1/24/2018	11-12 ft bgs	0.54	0	0.44	0	0.67	0	2.2	1				
on-site (EU15)	GP20-18	1/22/2018	11-12 ft bgs	0.3	0	0.25	0	13		0.37	0				
on-site (EU15)	TT-23	10/6/2008	7 ft BGS	8.4	0	8.4	0			17	0	9.9	0	9.9	0
on-site (EU15)	TT-23	10/6/2008	7 ft BGS					31	1						
on-site (EU15)	TT-43	11/8/2017	6-8 ft BGS	65	0	73	0	5200	1	230	1	4900	1	4200	1
on-site (EU15)	TT-43	11/8/2017	8-10 ft BGS												

Table B.13.3

Summary of ProUCL Input Data for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum	D_Aluminum	Antimony	D_Antimony
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS												
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS												
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS												
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	165	1	35	1	18	1	79.5	1	12500	1	0.33	1
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	190	1	33	1	29	1	84	1	2800	1	0.49	1
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	8850	1	1025	1	1230	1	4150	1	6850	1	6.9	1
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	400	1	20	0	70	1	200	1	6400	1	3.2	1
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	8.8	0	26	0	9.4	0	10	0	7200	1	1.3	1
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	160	1	22	0	24	1	69	1	5000	1	0.29	1
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	370	1	290	0	110	0	240	1	10000	1	12	1
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	83	1	24	0	8.7	0	38	1	8600	1	4.4	1
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	1100	1	50	1	140	1	460	1	6400	1	4.8	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	57	1	20	0	7.3	0	29	1	4700	1	1	1
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS												
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU15)	BH54-13	6/18/2013	4-6 ft BGS												
on-site (EU15)	BH55-13	6/18/2013	2-4 ft BGS												
on-site (EU15)	BH59-13	6/19/2013	2-4 ft BGS												
on-site (EU15)	BH143-18	1/23/2018	10-12 ft BGS	353.5	1	435	0	10.9	0	320	1	7900	1	1.7	1
on-site (EU15)	BH144-18	1/22/2018	14.5-16.5 ft BGS	21	1	33	0	0.8	0	11	1	9000	1	2.3	1
on-site (EU15)	BH145-18	1/22/2018	9-11 ft BGS	0.69	0	31	0	0.77	0	0.41	0	12000	1	0.23	1
on-site (EU15)	GP19-18	1/24/2018	11-12 ft bgs										1		
on-site (EU15)	GP20-18	1/22/2018	11-12 ft bgs												
on-site (EU15)	TT-23	10/6/2008	7 ft BGS	9.9	0	74	0	9.9	0	9.9	0				
on-site (EU15)	TT-23	10/6/2008	7 ft BGS									21700	1	70.1	1
on-site (EU15)	TT-43	11/8/2017	6-8 ft BGS	6100	1	860	1	680	1	2600	1	7200	1	38	1
on-site (EU15)	TT-43	11/8/2017	8-10 ft BGS												

Table B.13.3

Summary of ProUCL Input Data for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				24	25	26	27	28	29	30	31	32	33	34	35	36	37
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS														
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS														
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS														
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	10.75	1	88.5	1	0.4	1	0.74	1	8.55	1	30.5	1	0.235	0
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	4.7	1	160	1	0.28	1	0.25	0	3.2	1	25	1	0.2	0
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	26.5	1	980	1	4.8	1	6	1	11.5	1	800	1	0.49	0
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	11	1	1200	1	3.7	1	0.86	1	8.4	1	490	1	0.21	0
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	17	1	180	1	1.2	1	0.77	1	11	1	36	1	2.8	0
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	6.2	1	54	1	0.27	1	0.99	1	4.2	1	17	1	0.22	0
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	24	1	2900	1	16	1	1.5	0	29	1	2900	1	41	1
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	19	1	720	1	3.5	1	1.5	0	24	1	730	1	6.5	1
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	9.5	1	760	1	3.8	1	1.3	0	9	1	620	1	0.62	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	9.2	1	100	1	1.4	1	0.9	1	3.9	1	130	1	0.2	0
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS														
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS														
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS														
on-site (EU15)	BH54-13	6/18/2013	4-6 ft BGS														
on-site (EU15)	BH55-13	6/18/2013	2-4 ft BGS														
on-site (EU15)	BH59-13	6/19/2013	2-4 ft BGS														
on-site (EU15)	BH143-18	1/23/2018	10-12 ft BGS	51.5	1	290	1	0.705	1	0.75	1	14.5	1	62	1	1.07	1
on-site (EU15)	BH144-18	1/22/2018	14.5-16.5 ft BGS	15	1	210	1	0.77	1	0.38	1	8.6	1	170	1	0.16	0
on-site (EU15)	BH145-18	1/22/2018	9-11 ft BGS	12	1	93	1	0.24	1	1.4	0	7.4	1	22	1	0.12	0
on-site (EU15)	GP19-18	1/24/2018	11-12 ft bgs														
on-site (EU15)	GP20-18	1/22/2018	11-12 ft bgs														
on-site (EU15)	TT-23	10/6/2008	7 ft BGS							154	1					0.74	0
on-site (EU15)	TT-23	10/6/2008	7 ft BGS	20.1	1	3500	1	3.3	1			317	1	841	1		
on-site (EU15)	TT-43	11/8/2017	6-8 ft BGS	15	1	1100	1	5.6	1	7.4	1	15	1	1000	1	0.52	0
on-site (EU15)	TT-43	11/8/2017	8-10 ft BGS														

Table B.13.3

Summary of ProUCL Input Data for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				38	39	40	41	42	43	44	45	46	47
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Iron	D_Iron	Lead	D_Lead	Lead - coarse fraction	D_Lead - coarse fraction	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS										
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS										
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS										
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	23000	1	97.5	1						
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	8800	1	20	1	18	1	26	1	19	1
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	32500	1	1720	1						
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	28000	1	510	1						
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	9700	1	15	1						
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	12000	1	21	1						
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	100000	1	2200	1	2000	1	2700	1	2200	1
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	110000	1	490	1						
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	26000	1	720	1	1600	1	2000	1	1700	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	15000	1	220	1						
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS										
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS										
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS										
on-site (EU15)	BH54-13	6/18/2013	4-6 ft BGS										
on-site (EU15)	BH55-13	6/18/2013	2-4 ft BGS										
on-site (EU15)	BH59-13	6/19/2013	2-4 ft BGS										
on-site (EU15)	BH143-18	1/23/2018	10-12 ft BGS	12500	1	62.5	1						
on-site (EU15)	BH144-18	1/22/2018	14.5-16.5 ft BGS	24000	1	190	1						
on-site (EU15)	BH145-18	1/22/2018	9-11 ft BGS	23000	1	16	1						
on-site (EU15)	GP19-18	1/24/2018	11-12 ft bgs										
on-site (EU15)	GP20-18	1/22/2018	11-12 ft bgs										
on-site (EU15)	TT-23	10/6/2008	7 ft BGS										
on-site (EU15)	TT-23	10/6/2008	7 ft BGS	23600	1	17700	1						
on-site (EU15)	TT-43	11/8/2017	6-8 ft BGS	27000	1	2200	1						
on-site (EU15)	TT-43	11/8/2017	8-10 ft BGS										

Table B.13.3

Summary of ProUCL Input Data for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				48	49	50	51	52	53	54	55	56	57	58	59
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Manganese	D_Manganese	Mercury	D_Mercury	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc	Aroclor-1232 (PCB-1232)	D_Aroclor-1232 (PCB-1232)
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS												
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS												
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS												
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	405	1	3.2	1	0.27	1	30	1	75	1	27.5	0
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	390	1	0.019	0	0.075	1	12	1	61	1	24	0
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	1100	1	0.26	1	0.345	1	19	1	1450	1	25	0
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	340	1	0.19	1	0.26	1	18	1	830	1	23	0
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	34	1	0.22	1	0.65	1	29	1	500	1	32	0
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	320	1	0.051	1	0.13	1	16	1	45	1	26	0
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	820	1	0.66	1	0.22	1	50	1	5600	1	140	0
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	670	1	0.28	1	0.35	1	29	1	1600	1	30	0
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	450	1	0.19	1	0.21	1	17	1	920	1	1100	1
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	350	1	0.021	1	0.096	1	10	1	890	1	24	0
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS												
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS												
on-site (EU15)	BH54-13	6/18/2013	4-6 ft BGS												
on-site (EU15)	BH55-13	6/18/2013	2-4 ft BGS												
on-site (EU15)	BH59-13	6/19/2013	2-4 ft BGS												
on-site (EU15)	BH143-18	1/23/2018	10-12 ft BGS	62.5	1	1.06	1	1.3	1	67	1	60	1	180.5	0
on-site (EU15)	BH144-18	1/22/2018	14.5-16.5 ft BGS	340	1	0.057	1	0.34	1	31	1	390	1	28	0
on-site (EU15)	BH145-18	1/22/2018	9-11 ft BGS	560	1	0.024	0	0.19	1	29	1	76	1	26	0
on-site (EU15)	GP19-18	1/24/2018	11-12 ft bgs												
on-site (EU15)	GP20-18	1/22/2018	11-12 ft bgs												
on-site (EU15)	TT-23	10/6/2008	7 ft BGS	412	1			3.7	0					49	0
on-site (EU15)	TT-23	10/6/2008	7 ft BGS			0.084	1			42.4	1	19600	1		
on-site (EU15)	TT-43	11/8/2017	6-8 ft BGS	480	1	0.35	1	0.31	1	21	1	1700	1	180	0
on-site (EU15)	TT-43	11/8/2017	8-10 ft BGS												

Table B.13.3

Summary of ProUCL Input Data for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				60	61	62	63	64	65	66	67
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Aroclor-1260 (PCB-1260)	D_Aroclor-1260 (PCB-1260)
on-site (EU15)	BH51-13	6/21/2013	0-2 ft BGS								
on-site (EU15)	BH53-13	6/18/2013	0-2 ft BGS								
on-site (EU15)	SS-125	10/29/2018	0-2 ft BGS								
on-site (EU15)	SS-130	10/29/2018	0.25-2.25 ft BGS	23	0	29	0	86	1	26.5	0
on-site (EU15)	SS-131	10/29/2018	0-2 ft BGS	20	0	25	0	24	0	23	0
on-site (EU15)	SS-132	11/8/2017	0.7-2.7 ft BGS	31.5	0	1600	1	22	0	770	1
on-site (EU15)	SS-133	10/29/2018	0.5-2.5 ft BGS	19	0	24	0	150	1	22	0
on-site (EU15)	SS-134	10/29/2018	0.92-2.92 ft BGS	26	0	33	0	32	0	30	0
on-site (EU15)	SS-135	10/29/2018	0.25-2.25 ft BGS	22	0	28	0	26	0	170	1
on-site (EU15)	SS-136	10/29/2018	0-2 ft BGS	1100	1	150	0	1800	1	140	0
on-site (EU15)	SS-137	10/29/2018	0.17-2.17 ft BGS	25	0	32	0	30	0	29	0
on-site (EU15)	SS-141	10/29/2018	0-2 ft BGS	200	0	260	0	410	1	240	0
on-site (EU15)	SS-143	10/29/2018	0-2 ft BGS	20	0	25	0	24	0	44	1
on-site (EU15)	SS-171-AS	10/29/2018	0-0.5 ft BGS								
on-site (EU15)	SS-172-AS	10/29/2018	0.17-0.67 ft BGS								
on-site (EU15)	SS-173-AS	10/29/2018	0-0.5 ft BGS								
on-site (EU15)	BH54-13	6/18/2013	4-6 ft BGS								
on-site (EU15)	BH55-13	6/18/2013	2-4 ft BGS								
on-site (EU15)	BH59-13	6/19/2013	2-4 ft BGS								
on-site (EU15)	BH143-18	1/23/2018	10-12 ft BGS	230	1	186.5	0	560	1	170	0
on-site (EU15)	BH144-18	1/22/2018	14.5-16.5 ft BGS	23	0	29	0	28	0	27	0
on-site (EU15)	BH145-18	1/22/2018	9-11 ft BGS	22	0	28	0	26	0	25	0
on-site (EU15)	GP19-18	1/24/2018	11-12 ft bgs								
on-site (EU15)	GP20-18	1/22/2018	11-12 ft bgs								
on-site (EU15)	TT-23	10/6/2008	7 ft BGS	49	0	49	0	49	0	49	0
on-site (EU15)	TT-23	10/6/2008	7 ft BGS								
on-site (EU15)	TT-43	11/8/2017	6-8 ft BGS	220	0	8600	1	160	0	540	1
on-site (EU15)	TT-43	11/8/2017	8-10 ft BGS								

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	20	Number of Distinct Observations	18
		Number of Missing Observations	7
Number of Detects	1	Number of Non-Detects	19
Number of Distinct Detects	1	Number of Distinct Non-Detects	17

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,1-Dichloroethane was not processed!

Ethylbenzene

General Statistics

Total Number of Observations	20	Number of Distinct Observations	18
		Number of Missing Observations	7
Number of Detects	1	Number of Non-Detects	19
Number of Distinct Detects	1	Number of Distinct Non-Detects	17

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Ethylbenzene was not processed!

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	20	Number of Distinct Observations	19
		Number of Missing Observations	7
Number of Detects	14	Number of Non-Detects	6
Number of Distinct Detects	13	Number of Distinct Non-Detects	6
Minimum Detect	0.64	Minimum Non-Detect	0.38
Maximum Detect	5200	Maximum Non-Detect	13
Variance Detects	3458622	Percent Non-Detects	30%
Mean Detects	1429	SD Detects	1860
Median Detects	365.5	CV Detects	1.301
Skewness Detects	0.968	Kurtosis Detects	-0.551
Mean of Logged Detects	4.601	SD of Logged Detects	3.41

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.779	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.274	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1001	KM Standard Error of Mean	379.6
KM SD	1636	95% KM (BCA) UCL	1627
95% KM (t) UCL	1657	95% KM (Percentile Bootstrap) UCL	1654
95% KM (z) UCL	1625	95% KM Bootstrap t UCL	1889
90% KM Chebyshev UCL	2139	95% KM Chebyshev UCL	2655
97.5% KM Chebyshev UCL	3371	99% KM Chebyshev UCL	4778

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.898	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.849	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.25	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.264	k star (bias corrected MLE)	0.255
Theta hat (MLE)	5408	Theta star (bias corrected MLE)	5599
nu hat (MLE)	7.399	nu star (bias corrected)	7.147
Mean (detects)	1429		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1002
Maximum	5200	Median	8.25
SD	1678	CV	1.675
k hat (MLE)	0.162	k star (bias corrected MLE)	0.171
Theta hat (MLE)	6173	Theta star (bias corrected MLE)	5849
nu hat (MLE)	6.49	nu star (bias corrected)	6.85
Adjusted Level of Significance (β)	0.038		
Approximate Chi Square Value (6.85, α)	2.088	Adjusted Chi Square Value (6.85, β)	1.887
95% Gamma Approximate UCL (use when n>=50)	3285	95% Gamma Adjusted UCL (use when n<50)	3635

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1001	SD (KM)	1636
Variance (KM)	2676520	SE of Mean (KM)	379.6
k hat (KM)	0.374	k star (KM)	0.351
nu hat (KM)	14.96	nu star (KM)	14.05
theta hat (KM)	2675	theta star (KM)	2848
80% gamma percentile (KM)	1585	90% gamma percentile (KM)	2888
95% gamma percentile (KM)	4346	99% gamma percentile (KM)	8064

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (14.05, α)	6.606	Adjusted Chi Square Value (14.05, β)	6.206
95% Gamma Approximate KM-UCL (use when n>=50)	2128	95% Gamma Adjusted KM-UCL (use when n<50)	2266

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.856	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1000	Mean in Log Scale	2.509
SD in Original Scale	1679	SD in Log Scale	4.368
95% t UCL (assumes normality of ROS data)	1649	95% Percentile Bootstrap UCL	1621
95% BCA Bootstrap UCL	1671	95% Bootstrap t UCL	1894
95% H-UCL (Log ROS)	9.503E+8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.002	KM Geo Mean	20.12
KM SD (logged)	3.696	95% Critical H Value (KM-Log)	7.382
KM Standard Error of Mean (logged)	0.86	95% H-UCL (KM -Log)	9730921
KM SD (logged)	3.696	95% Critical H Value (KM-Log)	7.382
KM Standard Error of Mean (logged)	0.86		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1001	Mean in Log Scale	3.008
SD in Original Scale	1678	SD in Log Scale	3.824
95% t UCL (Assumes normality)	1650	95% H-Stat UCL	22324592

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	2266

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total)

General Statistics

Total Number of Observations	20	Number of Distinct Observations	17
		Number of Missing Observations	7
Number of Detects	7	Number of Non-Detects	13
Number of Distinct Detects	5	Number of Distinct Non-Detects	12
Minimum Detect	2.2	Minimum Non-Detect	0.36
Maximum Detect	2000000	Maximum Non-Detect	38
Variance Detects	5.713E+11	Percent Non-Detects	65%
Mean Detects	285943	SD Detects	755828
Median Detects	230	CV Detects	2.643
Skewness Detects	2.646	Kurtosis Detects	7
Mean of Logged Detects	6.116	SD of Logged Detects	4.141

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.454	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.504	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	100080	KM Standard Error of Mean	105273
KM SD	435871	95% KM (BCA) UCL	300076
95% KM (t) UCL	282111	95% KM (Percentile Bootstrap) UCL	300044
95% KM (z) UCL	273239	95% KM Bootstrap t UCL	5.330E+8
90% KM Chebyshev UCL	415899	95% KM Chebyshev UCL	558955
97.5% KM Chebyshev UCL	757510	99% KM Chebyshev UCL	1147533

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.399	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.89	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.455	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.351	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.123	k star (bias corrected MLE)	0.165
Theta hat (MLE)	2331603	Theta star (bias corrected MLE)	1729666
nu hat (MLE)	1.717	nu star (bias corrected)	2.314
Mean (detects)	285943		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	100080
Maximum	2000000	Median	0.01
SD	447195	CV	4.468
k hat (MLE)	0.0686	k star (bias corrected MLE)	0.0916
Theta hat (MLE)	1458778	Theta star (bias corrected MLE)	1092006
nu hat (MLE)	2.744	nu star (bias corrected)	3.666
Adjusted Level of Significance (β)	0.038		
Approximate Chi Square Value (3.67, α)	0.594	Adjusted Chi Square Value (3.67, β)	0.509
95% Gamma Approximate UCL (use when n>=50)	617302	95% Gamma Adjusted UCL (use when n<50)	720953

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	100080	SD (KM)	435871
Variance (KM)	1.900E+11	SE of Mean (KM)	105273
k hat (KM)	0.0527	k star (KM)	0.0781
nu hat (KM)	2.109	nu star (KM)	3.126
theta hat (KM)	1898313	theta star (KM)	1280686
80% gamma percentile (KM)	45471	90% gamma percentile (KM)	233750
95% gamma percentile (KM)	581268	99% gamma percentile (KM)	1792220

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.13, α)	0.411	Adjusted Chi Square Value (3.13, β)	0.347
95% Gamma Approximate KM-UCL (use when n>=50)	761799	95% Gamma Adjusted KM-UCL (use when n<50)	901120

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.817	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.296	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	100080	Mean in Log Scale	-1.852
SD in Original Scale	447195	SD in Log Scale	6.501
95% t UCL (assumes normality of ROS data)	272986	95% Percentile Bootstrap UCL	300051
95% BCA Bootstrap UCL	400073	95% Bootstrap t UCL	5.695E+8
95% H-UCL (Log ROS)	5.746E+16		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.544	KM Geo Mean	4.686
KM SD (logged)	4.064	95% Critical H Value (KM-Log)	7.804
KM Standard Error of Mean (logged)	0.987	95% H-UCL (KM -Log)	26118875
KM SD (logged)	4.064	95% Critical H Value (KM-Log)	7.804
KM Standard Error of Mean (logged)	0.987		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	100083	Mean in Log Scale	2.367
SD in Original Scale	447194	SD in Log Scale	3.896
95% t UCL (Assumes normality)	272989	95% H-Stat UCL	18627099

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	1147533

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Number of Detects	12	Number of Non-Detects	3
Number of Distinct Detects	12	Number of Distinct Non-Detects	3
Minimum Detect	11	Minimum Non-Detect	0.73
Maximum Detect	7050	Maximum Non-Detect	9.9
Variance Detects	5327609	Percent Non-Detects	20%
Mean Detects	1144	SD Detects	2308
Median Detects	190	CV Detects	2.018
Skewness Detects	2.212	Kurtosis Detects	3.884
Mean of Logged Detects	5.338	SD of Logged Detects	1.9

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.543	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.426	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	915	KM Standard Error of Mean	547.1
KM SD	2029	95% KM (BCA) UCL	1882
95% KM (t) UCL	1879	95% KM (Percentile Bootstrap) UCL	1869
95% KM (z) UCL	1815	95% KM Bootstrap t UCL	11312
90% KM Chebyshev UCL	2556	95% KM Chebyshev UCL	3300
97.5% KM Chebyshev UCL	4332	99% KM Chebyshev UCL	6359

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.146	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.807	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.322	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.262	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.388	k star (bias corrected MLE)	0.347
Theta hat (MLE)	2946	Theta star (bias corrected MLE)	3299
nu hat (MLE)	9.315	nu star (bias corrected)	8.32
Mean (detects)	1144		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	914.8
Maximum	7050	Median	135
SD	2100	CV	2.296
k hat (MLE)	0.21	k star (bias corrected MLE)	0.213
Theta hat (MLE)	4347	Theta star (bias corrected MLE)	4299
nu hat (MLE)	6.313	nu star (bias corrected)	6.384
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (6.38, α)	1.839	Adjusted Chi Square Value (6.38, β)	1.555
95% Gamma Approximate UCL (use when n>=50)	3176	95% Gamma Adjusted UCL (use when n<50)	3755

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	915	SD (KM)	2029
Variance (KM)	4115876	SE of Mean (KM)	547.1
k hat (KM)	0.203	k star (KM)	0.207
nu hat (KM)	6.102	nu star (KM)	6.215
theta hat (KM)	4498	theta star (KM)	4417
80% gamma percentile (KM)	1228	90% gamma percentile (KM)	2767
95% gamma percentile (KM)	4671	99% gamma percentile (KM)	9882

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.22, α)	1.751	Adjusted Chi Square Value (6.22, β)	1.476
95% Gamma Approximate KM-UCL (use when n>=50)	3248	95% Gamma Adjusted KM-UCL (use when n<50)	3853

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	915.3	Mean in Log Scale	4.457
SD in Original Scale	2100	SD in Log Scale	2.483
95% t UCL (assumes normality of ROS data)	1870	95% Percentile Bootstrap UCL	1875
95% BCA Bootstrap UCL	2290	95% Bootstrap t UCL	11416
95% H-UCL (Log ROS)	73465		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.208	KM Geo Mean	67.2
KM SD (logged)	2.786	95% Critical H Value (KM-Log)	6.134
KM Standard Error of Mean (logged)	0.751	95% H-UCL (KM -Log)	313561
KM SD (logged)	2.786	95% Critical H Value (KM-Log)	6.134
KM Standard Error of Mean (logged)	0.751		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	915.3	Mean in Log Scale	4.366
SD in Original Scale	2100	SD in Log Scale	2.674
95% t UCL (Assumes normality)	1870	95% H-Stat UCL	191235

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	4332	99% KM (Chebyshev) UCL	6359

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Number of Detects	12	Number of Non-Detects	3
Number of Distinct Detects	12	Number of Distinct Non-Detects	3
Minimum Detect	15	Minimum Non-Detect	0.75
Maximum Detect	6350	Maximum Non-Detect	13
Variance Detects	4129632	Percent Non-Detects	20%
Mean Detects	1059	SD Detects	2032
Median Detects	180	CV Detects	1.92
Skewness Detects	2.238	Kurtosis Detects	4.172
Mean of Logged Detects	5.425	SD of Logged Detects	1.836

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.571	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.405	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	847	KM Standard Error of Mean	483
KM SD	1791	95% KM (BCA) UCL	1694
95% KM (t) UCL	1698	95% KM (Percentile Bootstrap) UCL	1720
95% KM (z) UCL	1641	95% KM Bootstrap t UCL	7205
90% KM Chebyshev UCL	2296	95% KM Chebyshev UCL	2952
97.5% KM Chebyshev UCL	3863	99% KM Chebyshev UCL	5653

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.871	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.8	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.229	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.261	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.424	k star (bias corrected MLE)	0.373
Theta hat (MLE)	2499	Theta star (bias corrected MLE)	2836
nu hat (MLE)	10.17	nu star (bias corrected)	8.958
Mean (detects)	1059		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	846.9
Maximum	6350	Median	115
SD	1854	CV	2.189
k hat (MLE)	0.218	k star (bias corrected MLE)	0.219
Theta hat (MLE)	3877	Theta star (bias corrected MLE)	3863
nu hat (MLE)	6.554	nu star (bias corrected)	6.576
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (6.58, α)	1.941	Adjusted Chi Square Value (6.58, β)	1.647
95% Gamma Approximate UCL (use when n>=50)	2869	95% Gamma Adjusted UCL (use when n<50)	3381

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	847	SD (KM)	1791
Variance (KM)	3207438	SE of Mean (KM)	483
k hat (KM)	0.224	k star (KM)	0.223
nu hat (KM)	6.71	nu star (KM)	6.702
theta hat (KM)	3787	theta star (KM)	3792
80% gamma percentile (KM)	1177	90% gamma percentile (KM)	2558
95% gamma percentile (KM)	4236	99% gamma percentile (KM)	8776

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.70, α)	2.008	Adjusted Chi Square Value (6.70, β)	1.708
95% Gamma Approximate KM-UCL (use when n>=50)	2826	95% Gamma Adjusted KM-UCL (use when n<50)	3323

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.111	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	847.5	Mean in Log Scale	4.559
SD in Original Scale	1854	SD in Log Scale	2.422
95% t UCL (assumes normality of ROS data)	1690	95% Percentile Bootstrap UCL	1668
95% BCA Bootstrap UCL	2069	95% Bootstrap t UCL	7235
95% H-UCL (Log ROS)	59066		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.283	KM Geo Mean	72.44
KM SD (logged)	2.774	95% Critical H Value (KM-Log)	6.109
KM Standard Error of Mean (logged)	0.748	95% H-UCL (KM -Log)	314261
KM SD (logged)	2.774	95% Critical H Value (KM-Log)	6.109
KM Standard Error of Mean (logged)	0.748		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	847.7	Mean in Log Scale	4.506
SD in Original Scale	1853	SD in Log Scale	2.573
95% t UCL (Assumes normality)	1691	95% H-Stat UCL	125489

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	3323

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Number of Detects	12	Number of Non-Detects	3
Number of Distinct Detects	12	Number of Distinct Non-Detects	3
Minimum Detect	21	Minimum Non-Detect	0.69
Maximum Detect	8850	Maximum Non-Detect	9.9
Variance Detects	8246680	Percent Non-Detects	20%
Mean Detects	1487	SD Detects	2872
Median Detects	271.8	CV Detects	1.931
Skewness Detects	2.199	Kurtosis Detects	3.885
Mean of Logged Detects	5.793	SD of Logged Detects	1.777

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.563	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.398	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1190	KM Standard Error of Mean	682.3
KM SD	2530	95% KM (BCA) UCL	2439
95% KM (t) UCL	2392	95% KM (Percentile Bootstrap) UCL	2335
95% KM (z) UCL	2312	95% KM Bootstrap t UCL	10228
90% KM Chebyshev UCL	3237	95% KM Chebyshev UCL	4164
97.5% KM Chebyshev UCL	5451	99% KM Chebyshev UCL	7979

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.084	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.799	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.319	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.261	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.43	k star (bias corrected MLE)	0.378
Theta hat (MLE)	3458	Theta star (bias corrected MLE)	3933
nu hat (MLE)	10.32	nu star (bias corrected)	9.077
Mean (detects)	1487		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1190
Maximum	8850	Median	165
SD	2619	CV	2.201
k hat (MLE)	0.216	k star (bias corrected MLE)	0.217
Theta hat (MLE)	5512	Theta star (bias corrected MLE)	5480
nu hat (MLE)	6.476	nu star (bias corrected)	6.514
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (6.51, α)	1.908	Adjusted Chi Square Value (6.51, β)	1.617
95% Gamma Approximate UCL (use when n>=50)	4063	95% Gamma Adjusted UCL (use when n<50)	4793

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1190	SD (KM)	2530
Variance (KM)	6401242	SE of Mean (KM)	682.3
k hat (KM)	0.221	k star (KM)	0.221
nu hat (KM)	6.638	nu star (KM)	6.644
theta hat (KM)	5379	theta star (KM)	5374
80% gamma percentile (KM)	1647	90% gamma percentile (KM)	3595
95% gamma percentile (KM)	5966	99% gamma percentile (KM)	12390

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.64, α)	1.977	Adjusted Chi Square Value (6.64, β)	1.68
95% Gamma Approximate KM-UCL (use when n>=50)	3999	95% Gamma Adjusted KM-UCL (use when n<50)	4707

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1191	Mean in Log Scale	4.966
SD in Original Scale	2618	SD in Log Scale	2.325
95% t UCL (assumes normality of ROS data)	2382	95% Percentile Bootstrap UCL	2371
95% BCA Bootstrap UCL	2880	95% Bootstrap t UCL	10312
95% H-UCL (Log ROS)	54446		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.56	KM Geo Mean	95.59
KM SD (logged)	2.897	95% Critical H Value (KM-Log)	6.36
KM Standard Error of Mean (logged)	0.781	95% H-UCL (KM -Log)	874487
KM SD (logged)	2.897	95% Critical H Value (KM-Log)	6.36
KM Standard Error of Mean (logged)	0.781		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1191	Mean in Log Scale	4.769
SD in Original Scale	2619	SD in Log Scale	2.702
95% t UCL (Assumes normality)	2381	95% H-Stat UCL	335453

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	5451	99% KM (Chebyshev) UCL	7979

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	15	Number of Distinct Observations	13
		Number of Missing Observations	12
Number of Detects	5	Number of Non-Detects	10
Number of Distinct Detects	5	Number of Distinct Non-Detects	9
Minimum Detect	33	Minimum Non-Detect	20
Maximum Detect	1025	Maximum Non-Detect	435
Variance Detects	248159	Percent Non-Detects	66.67%
Mean Detects	400.6	SD Detects	498.2
Median Detects	50	CV Detects	1.244
Skewness Detects	0.67	Kurtosis Detects	-2.971
Mean of Logged Detects	4.931	SD of Logged Detects	1.756

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.742	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.359	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	148	KM Standard Error of Mean	90.43
KM SD	313.2	95% KM (BCA) UCL	324.5
95% KM (t) UCL	307.3	95% KM (Percentile Bootstrap) UCL	283.3
95% KM (z) UCL	296.8	95% KM Bootstrap t UCL	2959
90% KM Chebyshev UCL	419.3	95% KM Chebyshev UCL	542.2
97.5% KM Chebyshev UCL	712.7	99% KM Chebyshev UCL	1048

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.749	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.707	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.363	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.37	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.584	k star (bias corrected MLE)	0.367
Theta hat (MLE)	686	Theta star (bias corrected MLE)	1092
nu hat (MLE)	5.84	nu star (bias corrected)	3.669
Mean (detects)	400.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	133.5
Maximum	1025	Median	0.01
SD	330.3	CV	2.474
k hat (MLE)	0.125	k star (bias corrected MLE)	0.144
Theta hat (MLE)	1070	Theta star (bias corrected MLE)	925.6
nu hat (MLE)	3.744	nu star (bias corrected)	4.328
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (4.33, α)	0.856	Adjusted Chi Square Value (4.33, β)	0.687
95% Gamma Approximate UCL (use when n>=50)	675.6	95% Gamma Adjusted UCL (use when n<50)	841.8

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	148	SD (KM)	313.2
Variance (KM)	98096	SE of Mean (KM)	90.43
k hat (KM)	0.223	k star (KM)	0.223
nu hat (KM)	6.701	nu star (KM)	6.694
theta hat (KM)	662.7	theta star (KM)	663.4
80% gamma percentile (KM)	205.6	90% gamma percentile (KM)	447
95% gamma percentile (KM)	740.5	99% gamma percentile (KM)	1535

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.69, α)	2.004	Adjusted Chi Square Value (6.69, β)	1.704
95% Gamma Approximate KM-UCL (use when n>=50)	494.4	95% Gamma Adjusted KM-UCL (use when n<50)	581.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.758	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	134.7	Mean in Log Scale	1.885
SD in Original Scale	329.8	SD in Log Scale	2.486
95% t UCL (assumes normality of ROS data)	284.7	95% Percentile Bootstrap UCL	268.9
95% BCA Bootstrap UCL	331.4	95% Bootstrap t UCL	2710
95% H-UCL (Log ROS)	5689		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.68	KM Geo Mean	39.66
KM SD (logged)	1.276	95% Critical H Value (KM-Log)	3.209
KM Standard Error of Mean (logged)	0.371	95% H-UCL (KM -Log)	267.7
KM SD (logged)	1.276	95% Critical H Value (KM-Log)	3.209
KM Standard Error of Mean (logged)	0.371		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	166	Mean in Log Scale	3.748
SD in Original Scale	322.1	SD in Log Scale	1.568
95% t UCL (Assumes normality)	312.5	95% H-Stat UCL	695

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	581.4

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Number of Detects	7	Number of Non-Detects	8
Number of Distinct Detects	7	Number of Distinct Non-Detects	8
Minimum Detect	18	Minimum Non-Detect	0.77
Maximum Detect	1230	Maximum Non-Detect	110
Variance Detects	219293	Percent Non-Detects	53.33%
Mean Detects	313	SD Detects	468.3
Median Detects	70	CV Detects	1.496
Skewness Detects	1.655	Kurtosis Detects	1.885
Mean of Logged Detects	4.609	SD of Logged Detects	1.669

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.715	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.358	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	147.3	KM Standard Error of Mean	93.25
KM SD	334.3	95% KM (BCA) UCL	314.4
95% KM (t) UCL	311.6	95% KM (Percentile Bootstrap) UCL	302.7
95% KM (z) UCL	300.7	95% KM Bootstrap t UCL	1309
90% KM Chebyshev UCL	427.1	95% KM Chebyshev UCL	553.8
97.5% KM Chebyshev UCL	729.7	99% KM Chebyshev UCL	1075

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.565	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.326	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.55	k star (bias corrected MLE)	0.41
Theta hat (MLE)	568.7	Theta star (bias corrected MLE)	763.9
nu hat (MLE)	7.705	nu star (bias corrected)	5.736
Mean (detects)	313		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	146.1
Maximum	1230	Median	0.01
SD	346.6	CV	2.373
k hat (MLE)	0.146	k star (bias corrected MLE)	0.161
Theta hat (MLE)	1001	Theta star (bias corrected MLE)	906.4
nu hat (MLE)	4.377	nu star (bias corrected)	4.835
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (4.83, α)	1.077	Adjusted Chi Square Value (4.83, β)	0.878
95% Gamma Approximate UCL (use when n>=50)	656	95% Gamma Adjusted UCL (use when n<50)	804.3

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	147.3	SD (KM)	334.3
Variance (KM)	111775	SE of Mean (KM)	93.25
k hat (KM)	0.194	k star (KM)	0.2
nu hat (KM)	5.824	nu star (KM)	5.993
theta hat (KM)	758.8	theta star (KM)	737.4
80% gamma percentile (KM)	194	90% gamma percentile (KM)	445.5
95% gamma percentile (KM)	759.3	99% gamma percentile (KM)	1623

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.99, α)	1.636	Adjusted Chi Square Value (5.99, β)	1.373
95% Gamma Approximate KM-UCL (use when n>=50)	539.5	95% Gamma Adjusted KM-UCL (use when n<50)	642.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	146.9	Mean in Log Scale	2.327
SD in Original Scale	346.2	SD in Log Scale	2.484
95% t UCL (assumes normality of ROS data)	304.3	95% Percentile Bootstrap UCL	302.1
95% BCA Bootstrap UCL	381.6	95% Bootstrap t UCL	1304
95% H-UCL (Log ROS)	8781		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.101	KM Geo Mean	8.172
KM SD (logged)	2.634	95% Critical H Value (KM-Log)	5.827
KM Standard Error of Mean (logged)	0.747	95% H-UCL (KM -Log)	15887
KM SD (logged)	2.634	95% Critical H Value (KM-Log)	5.827
KM Standard Error of Mean (logged)	0.747		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	151.3	Mean in Log Scale	2.8
SD in Original Scale	344.5	SD in Log Scale	2.349
95% t UCL (Assumes normality)	308	95% H-Stat UCL	7031

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	642.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Number of Detects	12	Number of Non-Detects	3
Number of Distinct Detects	12	Number of Distinct Non-Detects	3
Minimum Detect	11	Minimum Non-Detect	0.41
Maximum Detect	4150	Maximum Non-Detect	10
Variance Detects	1700068	Percent Non-Detects	20%
Mean Detects	690	SD Detects	1304
Median Detects	142	CV Detects	1.89
Skewness Detects	2.291	Kurtosis Detects	4.567
Mean of Logged Detects	5.11	SD of Logged Detects	1.756

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.575	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.403	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	552.1	KM Standard Error of Mean	310.2
KM SD	1150	95% KM (BCA) UCL	1147
95% KM (t) UCL	1098	95% KM (Percentile Bootstrap) UCL	1088
95% KM (z) UCL	1062	95% KM Bootstrap t UCL	4545
90% KM Chebyshev UCL	1483	95% KM Chebyshev UCL	1904
97.5% KM Chebyshev UCL	2489	99% KM Chebyshev UCL	3638

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.869	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.794	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.233	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.26	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.452	k star (bias corrected MLE)	0.395
Theta hat (MLE)	1526	Theta star (bias corrected MLE)	1748
nu hat (MLE)	10.85	nu star (bias corrected)	9.472
Mean (detects)	690		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	552
Maximum	4150	Median	79.5
SD	1191	CV	2.157
k hat (MLE)	0.229	k star (bias corrected MLE)	0.228
Theta hat (MLE)	2411	Theta star (bias corrected MLE)	2426
nu hat (MLE)	6.868	nu star (bias corrected)	6.827
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (6.83, α)	2.076	Adjusted Chi Square Value (6.83, β)	1.77
95% Gamma Approximate UCL (use when n>=50)	1815	95% Gamma Adjusted UCL (use when n<50)	2130

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	552.1	SD (KM)	1150
Variance (KM)	1322812	SE of Mean (KM)	310.2
k hat (KM)	0.23	k star (KM)	0.229
nu hat (KM)	6.913	nu star (KM)	6.864
theta hat (KM)	2396	theta star (KM)	2413
80% gamma percentile (KM)	774.9	90% gamma percentile (KM)	1666
95% gamma percentile (KM)	2742	99% gamma percentile (KM)	5645

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.86, α)	2.096	Adjusted Chi Square Value (6.86, β)	1.788
95% Gamma Approximate KM-UCL (use when n>=50)	1808	95% Gamma Adjusted KM-UCL (use when n<50)	2120

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.15	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	552.6	Mean in Log Scale	4.283
SD in Original Scale	1190	SD in Log Scale	2.313
95% t UCL (assumes normality of ROS data)	1094	95% Percentile Bootstrap UCL	1094
95% BCA Bootstrap UCL	1359	95% Bootstrap t UCL	4304
95% H-UCL (Log ROS)	25885		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.909	KM Geo Mean	49.87
KM SD (logged)	2.833	95% Critical H Value (KM-Log)	6.229
KM Standard Error of Mean (logged)	0.764	95% H-UCL (KM -Log)	307911
KM SD (logged)	2.833	95% Critical H Value (KM-Log)	6.229
KM Standard Error of Mean (logged)	0.764		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	552.7	Mean in Log Scale	4.196
SD in Original Scale	1190	SD in Log Scale	2.547
95% t UCL (Assumes normality)	1094	95% H-Stat UCL	79612

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	2120

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	15	Number of Distinct Observations	13
		Number of Missing Observations	12
Minimum	2800	Mean	8550
Maximum	21700	Median	7200
SD	4468	Std. Error of Mean	1154
Coefficient of Variation	0.523	Skewness	1.902

Normal GOF Test

Shapiro Wilk Test Statistic	0.835	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	10582	95% Adjusted-CLT UCL (Chen-1995)	11053
		95% Modified-t UCL (Johnson-1978)	10676

Gamma GOF Test

A-D Test Statistic	0.351	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.129	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.222	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.816	k star (bias corrected MLE)	3.897
Theta hat (MLE)	1775	Theta star (bias corrected MLE)	2194
nu hat (MLE)	144.5	nu star (bias corrected)	116.9
MLE Mean (bias corrected)	8550	MLE Sd (bias corrected)	4331
		Approximate Chi Square Value (0.05)	92.95
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	90.32

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	10754	95% Adjusted Gamma UCL (use when n<50)	11067

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.937	Mean of logged Data	8.946
Maximum of Logged Data	9.985	SD of logged Data	0.475

Assuming Lognormal Distribution

95% H-UCL	11136	90% Chebyshev (MVUE) UCL	11745
95% Chebyshev (MVUE) UCL	13204	97.5% Chebyshev (MVUE) UCL	15229
99% Chebyshev (MVUE) UCL	19205		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCLs

95% CLT UCL	10447	95% Jackknife UCL	10582
95% Standard Bootstrap UCL	10405	95% Bootstrap-t UCL	11773
95% Hall's Bootstrap UCL	20071	95% Percentile Bootstrap UCL	10497
95% BCA Bootstrap UCL	11230		
90% Chebyshev(Mean, Sd) UCL	12011	95% Chebyshev(Mean, Sd) UCL	13578
97.5% Chebyshev(Mean, Sd) UCL	15754	99% Chebyshev(Mean, Sd) UCL	20027

Suggested UCL to Use

95% Student's-t UCL	10582

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Minimum	0.23	Mean	9.803
Maximum	70.1	Median	2.3
SD	19.22	Std. Error of Mean	4.963
Coefficient of Variation	1.961	Skewness	2.732

Normal GOF Test

Shapiro Wilk Test Statistic	0.552	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.36	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	18.54	95% Adjusted-CLT UCL (Chen-1995)	21.71
		95% Modified-t UCL (Johnson-1978)	19.13

Gamma GOF Test

A-D Test Statistic	0.814	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.8	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.205	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.235	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.467	k star (bias corrected MLE)	0.418
Theta hat (MLE)	21	Theta star (bias corrected MLE)	23.45
nu hat (MLE)	14.01	nu star (bias corrected)	12.54
MLE Mean (bias corrected)	9.803	MLE Sd (bias corrected)	15.16
		Approximate Chi Square Value (0.05)	5.584
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	5.023

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	22.01	95% Adjusted Gamma UCL (use when n<50)	24.47

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0939	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.47	Mean of logged Data	0.908
Maximum of Logged Data	4.25	SD of logged Data	1.718

Assuming Lognormal Distribution

95% H-UCL	68.68	90% Chebyshev (MVUE) UCL	22.52
95% Chebyshev (MVUE) UCL	28.69	97.5% Chebyshev (MVUE) UCL	37.25
99% Chebyshev (MVUE) UCL	54.07		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	17.97	95% Jackknife UCL	18.54
95% Standard Bootstrap UCL	17.86	95% Bootstrap-t UCL	52.72
95% Hall's Bootstrap UCL	53.64	95% Percentile Bootstrap UCL	18.62
95% BCA Bootstrap UCL	21.51		
90% Chebyshev(Mean, Sd) UCL	24.69	95% Chebyshev(Mean, Sd) UCL	31.44
97.5% Chebyshev(Mean, Sd) UCL	40.8	99% Chebyshev(Mean, Sd) UCL	59.18

Suggested UCL to Use

95% Adjusted Gamma UCL	24.47

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	12
Minimum	4.7	Mean	16.76
Maximum	51.5	Median	15
SD	11.45	Std. Error of Mean	2.956
Coefficient of Variation	0.683	Skewness	2.141

Normal GOF Test

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	21.97	95% Adjusted-CLT UCL (Chen-1995)	23.37
		95% Modified-t UCL (Johnson-1978)	22.24

Gamma GOF Test

A-D Test Statistic	0.275	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.106	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.223	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.045	k star (bias corrected MLE)	2.481
Theta hat (MLE)	5.505	Theta star (bias corrected MLE)	6.758
nu hat (MLE)	91.35	nu star (bias corrected)	74.42
MLE Mean (bias corrected)	16.76	MLE Sd (bias corrected)	10.64
		Approximate Chi Square Value (0.05)	55.55
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	53.55

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	22.46	95% Adjusted Gamma UCL (use when n<50)	23.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.984	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.104	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.548	Mean of logged Data	2.646
Maximum of Logged Data	3.942	SD of logged Data	0.597

Assuming Lognormal Distribution

95% H-UCL	23.86	90% Chebyshev (MVUE) UCL	24.64
95% Chebyshev (MVUE) UCL	28.27	97.5% Chebyshev (MVUE) UCL	33.3
99% Chebyshev (MVUE) UCL	43.2		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	21.63	95% Jackknife UCL	21.97
95% Standard Bootstrap UCL	21.62	95% Bootstrap-t UCL	25.16
95% Hall's Bootstrap UCL	44.38	95% Percentile Bootstrap UCL	21.59
95% BCA Bootstrap UCL	23.5		
90% Chebyshev(Mean, Sd) UCL	25.63	95% Chebyshev(Mean, Sd) UCL	29.65
97.5% Chebyshev(Mean, Sd) UCL	35.23	99% Chebyshev(Mean, Sd) UCL	46.18

Suggested UCL to Use

95% Student's-t UCL	21.97

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Minimum	54	Mean	822.4
Maximum	3500	Median	290
SD	1050	Std. Error of Mean	271.1
Coefficient of Variation	1.277	Skewness	1.829

Normal GOF Test

Shapiro Wilk Test Statistic	0.728	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1300	95% Adjusted-CLT UCL (Chen-1995)	1405
		95% Modified-t UCL (Johnson-1978)	1321

Gamma GOF Test

A-D Test Statistic	0.573	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.774	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.185	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.23	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.779	k star (bias corrected MLE)	0.668
Theta hat (MLE)	1055	Theta star (bias corrected MLE)	1231
nu hat (MLE)	23.38	nu star (bias corrected)	20.04
MLE Mean (bias corrected)	822.4	MLE Sd (bias corrected)	1006
		Approximate Chi Square Value (0.05)	10.88
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	10.06

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1515	95% Adjusted Gamma UCL (use when n<50)	1639

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.149	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.989	Mean of logged Data	5.948
Maximum of Logged Data	8.161	SD of logged Data	1.329

Assuming Lognormal Distribution

95% H-UCL	2992	90% Chebyshev (MVUE) UCL	1817
95% Chebyshev (MVUE) UCL	2259	97.5% Chebyshev (MVUE) UCL	2873
99% Chebyshev (MVUE) UCL	4079		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1268	95% Jackknife UCL	1300
95% Standard Bootstrap UCL	1250	95% Bootstrap-t UCL	1809
95% Hall's Bootstrap UCL	3655	95% Percentile Bootstrap UCL	1289
95% BCA Bootstrap UCL	1420		
90% Chebyshev(Mean, Sd) UCL	1636	95% Chebyshev(Mean, Sd) UCL	2004
97.5% Chebyshev(Mean, Sd) UCL	2516	99% Chebyshev(Mean, Sd) UCL	3520

Suggested UCL to Use

95% Adjusted Gamma UCL	1639

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Minimum	0.24	Mean	3.064
Maximum	16	Median	1.4
SD	4.015	Std. Error of Mean	1.037
Coefficient of Variation	1.31	Skewness	2.631

Normal GOF Test

Shapiro Wilk Test Statistic	0.679	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4.89	95% Adjusted-CLT UCL (Chen-1995)	5.522
		95% Modified-t UCL (Johnson-1978)	5.008

Gamma GOF Test

A-D Test Statistic	0.476	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.771	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.136	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.229	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.831	k star (bias corrected MLE)	0.709
Theta hat (MLE)	3.688	Theta star (bias corrected MLE)	4.321
nu hat (MLE)	24.93	nu star (bias corrected)	21.27
MLE Mean (bias corrected)	3.064	MLE Sd (bias corrected)	3.639
		Approximate Chi Square Value (0.05)	11.8
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	10.93

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	5.527	95% Adjusted Gamma UCL (use when n<50)	5.962

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.194	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.427	Mean of logged Data	0.409
Maximum of Logged Data	2.773	SD of logged Data	1.3

Assuming Lognormal Distribution

95% H-UCL	10.83	90% Chebyshev (MVUE) UCL	6.82
95% Chebyshev (MVUE) UCL	8.461	97.5% Chebyshev (MVUE) UCL	10.74
99% Chebyshev (MVUE) UCL	15.21		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4.769	95% Jackknife UCL	4.89
95% Standard Bootstrap UCL	4.686	95% Bootstrap-t UCL	6.605
95% Hall's Bootstrap UCL	11.69	95% Percentile Bootstrap UCL	4.809
95% BCA Bootstrap UCL	5.468		
90% Chebyshev(Mean, Sd) UCL	6.174	95% Chebyshev(Mean, Sd) UCL	7.583
97.5% Chebyshev(Mean, Sd) UCL	9.538	99% Chebyshev(Mean, Sd) UCL	13.38

Suggested UCL to Use

95% Adjusted Gamma UCL	5.962

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	12
Number of Detects	10	Number of Non-Detects	5
Number of Distinct Detects	10	Number of Distinct Non-Detects	4
Minimum Detect	0.38	Minimum Non-Detect	0.25
Maximum Detect	154	Maximum Non-Detect	1.5
Variance Detects	2314	Percent Non-Detects	33.33%
Mean Detects	17.28	SD Detects	48.1
Median Detects	0.88	CV Detects	2.784
Skewness Detects	3.147	Kurtosis Detects	9.926
Mean of Logged Detects	0.675	SD of Logged Detects	1.803

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.402	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.481	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	11.72	KM Standard Error of Mean	10.36
KM SD	38.08	95% KM (BCA) UCL	32.53
95% KM (t) UCL	29.98	95% KM (Percentile Bootstrap) UCL	31.9
95% KM (z) UCL	28.77	95% KM Bootstrap t UCL	314.6
90% KM Chebyshev UCL	42.82	95% KM Chebyshev UCL	56.9
97.5% KM Chebyshev UCL	76.45	99% KM Chebyshev UCL	114.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.914	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.811	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.386	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.287	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.315	k star (bias corrected MLE)	0.287
Theta hat (MLE)	54.92	Theta star (bias corrected MLE)	60.23
nu hat (MLE)	6.292	nu star (bias corrected)	5.738
Mean (detects)	17.28		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	11.52
Maximum	154	Median	0.75
SD	39.48	CV	3.426
k hat (MLE)	0.207	k star (bias corrected MLE)	0.21
Theta hat (MLE)	55.58	Theta star (bias corrected MLE)	54.79
nu hat (MLE)	6.22	nu star (bias corrected)	6.309
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (6.31, α)	1.8	Adjusted Chi Square Value (6.31, β)	1.52
95% Gamma Approximate UCL (use when n>=50)	40.39	95% Gamma Adjusted UCL (use when n<50)	47.83

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	11.72	SD (KM)	38.08
Variance (KM)	1450	SE of Mean (KM)	10.36
k hat (KM)	0.0948	k star (KM)	0.12
nu hat (KM)	2.844	nu star (KM)	3.608
theta hat (KM)	123.7	theta star (KM)	97.48
80% gamma percentile (KM)	10.31	90% gamma percentile (KM)	33.24
95% gamma percentile (KM)	66.88	99% gamma percentile (KM)	169.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.61, α)	0.573	Adjusted Chi Square Value (3.61, β)	0.448
95% Gamma Approximate KM-UCL (use when n>=50)	73.78	95% Gamma Adjusted KM-UCL (use when n<50)	94.39

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.749	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.348	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	11.73	Mean in Log Scale	0.148
SD in Original Scale	39.42	SD in Log Scale	1.772
95% t UCL (assumes normality of ROS data)	29.65	95% Percentile Bootstrap UCL	31.86
95% BCA Bootstrap UCL	42.08	95% Bootstrap t UCL	314.4
95% H-UCL (Log ROS)	39.25		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.242	KM Geo Mean	1.273
KM SD (logged)	1.558	95% Critical H Value (KM-Log)	3.719
KM Standard Error of Mean (logged)	0.431	95% H-UCL (KM -Log)	20.17
KM SD (logged)	1.558	95% Critical H Value (KM-Log)	3.719
KM Standard Error of Mean (logged)	0.431		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	11.72	Mean in Log Scale	0.22
SD in Original Scale	39.42	SD in Log Scale	1.645
95% t UCL (Assumes normality)	29.64	95% H-Stat UCL	26.55

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	76.45

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Minimum	3.2	Mean	31.68
Maximum	317	Median	9
SD	79.25	Std. Error of Mean	20.46
Coefficient of Variation	2.501	Skewness	3.82

Normal GOF Test

Shapiro Wilk Test Statistic	0.358	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.447	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	67.72	95% Adjusted-CLT UCL (Chen-1995)	86.91
		95% Modified-t UCL (Johnson-1978)	71.09

Gamma GOF Test

A-D Test Statistic	2.353	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.784	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.333	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.232	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.626	k star (bias corrected MLE)	0.545
Theta hat (MLE)	50.65	Theta star (bias corrected MLE)	58.15
nu hat (MLE)	18.77	nu star (bias corrected)	16.35
MLE Mean (bias corrected)	31.68	MLE Sd (bias corrected)	42.92
		Approximate Chi Square Value (0.05)	8.207
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	7.506

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	63.11	95% Adjusted Gamma UCL (use when n<50)	69

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.816	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.163	Mean of logged Data	2.474
Maximum of Logged Data	5.759	SD of logged Data	1.097

Assuming Lognormal Distribution

95% H-UCL	50.74	90% Chebyshev (MVUE) UCL	39.63
95% Chebyshev (MVUE) UCL	48.32	97.5% Chebyshev (MVUE) UCL	60.38
99% Chebyshev (MVUE) UCL	84.07		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	65.34	95% Jackknife UCL	67.72
95% Standard Bootstrap UCL	63.75	95% Bootstrap-t UCL	364.4
95% Hall's Bootstrap UCL	221.5	95% Percentile Bootstrap UCL	71.87
95% BCA Bootstrap UCL	94.44		
90% Chebyshev(Mean, Sd) UCL	93.07	95% Chebyshev(Mean, Sd) UCL	120.9
97.5% Chebyshev(Mean, Sd) UCL	159.5	99% Chebyshev(Mean, Sd) UCL	235.3

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	120.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Minimum	17	Mean	524.9
Maximum	2900	Median	170
SD	748.1	Std. Error of Mean	193.2
Coefficient of Variation	1.425	Skewness	2.508

Normal GOF Test

Shapiro Wilk Test Statistic	0.684	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	865.1	95% Adjusted-CLT UCL (Chen-1995)	976.3
		95% Modified-t UCL (Johnson-1978)	886

Gamma GOF Test

A-D Test Statistic	0.602	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.787	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.233	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.577	k star (bias corrected MLE)	0.506
Theta hat (MLE)	909.7	Theta star (bias corrected MLE)	1037
nu hat (MLE)	17.31	nu star (bias corrected)	15.18
MLE Mean (bias corrected)	524.9	MLE Sd (bias corrected)	737.9
		Approximate Chi Square Value (0.05)	7.388
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	6.727

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1079	95% Adjusted Gamma UCL (use when n<50)	1184

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.19	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.833	Mean of logged Data	5.186
Maximum of Logged Data	7.972	SD of logged Data	1.704

Assuming Lognormal Distribution

95% H-UCL	4698	90% Chebyshev (MVUE) UCL	1584
95% Chebyshev (MVUE) UCL	2016	97.5% Chebyshev (MVUE) UCL	2616
99% Chebyshev (MVUE) UCL	3795		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	842.6	95% Jackknife UCL	865.1
95% Standard Bootstrap UCL	831.5	95% Bootstrap-t UCL	1152
95% Hall's Bootstrap UCL	2132	95% Percentile Bootstrap UCL	869.4
95% BCA Bootstrap UCL	974.6		
90% Chebyshev(Mean, Sd) UCL	1104	95% Chebyshev(Mean, Sd) UCL	1367
97.5% Chebyshev(Mean, Sd) UCL	1731	99% Chebyshev(Mean, Sd) UCL	2447

Suggested UCL to Use

95% Adjusted Gamma UCL	1184

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	12
Number of Detects	4	Number of Non-Detects	11
Number of Distinct Detects	4	Number of Distinct Non-Detects	10
Minimum Detect	0.62	Minimum Non-Detect	0.12
Maximum Detect	41	Maximum Non-Detect	2.8
Variance Detects	373.3	Percent Non-Detects	73.33%
Mean Detects	12.3	SD Detects	19.32
Median Detects	3.785	CV Detects	1.571
Skewness Detects	1.89	Kurtosis Detects	3.588
Mean of Logged Detects	1.294	SD of Logged Detects	1.9

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.733	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.368	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.379	KM Standard Error of Mean	3.035
KM SD	10.18	95% KM (BCA) UCL	N/A
95% KM (t) UCL	8.724	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	8.37	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	12.48	95% KM Chebyshev UCL	16.61
97.5% KM Chebyshev UCL	22.33	99% KM Chebyshev UCL	33.57

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.372	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.68	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.278	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.41	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.519	k star (bias corrected MLE)	0.297
Theta hat (MLE)	23.67	Theta star (bias corrected MLE)	41.47
nu hat (MLE)	4.155	nu star (bias corrected)	2.372
Mean (detects)	12.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.287
Maximum	41	Median	0.01
SD	10.57	CV	3.215
k hat (MLE)	0.178	k star (bias corrected MLE)	0.186
Theta hat (MLE)	18.51	Theta star (bias corrected MLE)	17.63
nu hat (MLE)	5.326	nu star (bias corrected)	5.594
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (5.59, α)	1.436	Adjusted Chi Square Value (5.59, β)	1.195
95% Gamma Approximate UCL (use when n>=50)	12.8	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.379	SD (KM)	10.18
Variance (KM)	103.6	SE of Mean (KM)	3.035
k hat (KM)	0.11	k star (KM)	0.133
nu hat (KM)	3.307	nu star (KM)	3.979
theta hat (KM)	30.66	theta star (KM)	25.48
80% gamma percentile (KM)	3.293	90% gamma percentile (KM)	9.808
95% gamma percentile (KM)	19.01	99% gamma percentile (KM)	46.43

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.98, α)	0.713	Adjusted Chi Square Value (3.98, β)	0.565
95% Gamma Approximate KM-UCL (use when n>=50)	18.85	95% Gamma Adjusted KM-UCL (use when n<50)	23.78

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.241	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.285	Mean in Log Scale	-3.414
SD in Original Scale	10.57	SD in Log Scale	3.121
95% t UCL (assumes normality of ROS data)	8.09	95% Percentile Bootstrap UCL	8.68
95% BCA Bootstrap UCL	11.48	95% Bootstrap t UCL	112.4
95% H-UCL (Log ROS)	1260		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.177	KM Geo Mean	0.308
KM SD (logged)	1.732	95% Critical H Value (KM-Log)	4.047
KM Standard Error of Mean (logged)	0.522	95% H-UCL (KM -Log)	9.004
KM SD (logged)	1.732	95% Critical H Value (KM-Log)	4.047
KM Standard Error of Mean (logged)	0.522		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.476	Mean in Log Scale	-0.986
SD in Original Scale	10.51	SD in Log Scale	1.838
95% t UCL (Assumes normality)	8.255	95% H-Stat UCL	16.29

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	8.724

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	12
Minimum	8800	Mean	31673
Maximum	110000	Median	23600
SD	30689	Std. Error of Mean	7924
Coefficient of Variation	0.969	Skewness	2.153

Normal GOF Test

Shapiro Wilk Test Statistic	0.641	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.356	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	45629	95% Adjusted-CLT UCL (Chen-1995)	49414
		95% Modified-t UCL (Johnson-1978)	46364

Gamma GOF Test

A-D Test Statistic	1.197	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.749	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.266	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.225	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.86	k star (bias corrected MLE)	1.533
Theta hat (MLE)	17025	Theta star (bias corrected MLE)	20664
nu hat (MLE)	55.81	nu star (bias corrected)	45.98
MLE Mean (bias corrected)	31673	MLE Sd (bias corrected)	25583
		Approximate Chi Square Value (0.05)	31.42
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	29.95

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	46346	95% Adjusted Gamma UCL (use when n<50)	48633

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.208	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.083	Mean of logged Data	10.07
Maximum of Logged Data	11.61	SD of logged Data	0.729

Assuming Lognormal Distribution

95% H-UCL	48724	90% Chebyshev (MVUE) UCL	48237
95% Chebyshev (MVUE) UCL	56409	97.5% Chebyshev (MVUE) UCL	67751
99% Chebyshev (MVUE) UCL	90030		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	44707	95% Jackknife UCL	45629
95% Standard Bootstrap UCL	44489	95% Bootstrap-t UCL	78387
95% Hall's Bootstrap UCL	133959	95% Percentile Bootstrap UCL	45053
95% BCA Bootstrap UCL	49100		
90% Chebyshev(Mean, Sd) UCL	55445	95% Chebyshev(Mean, Sd) UCL	66212
97.5% Chebyshev(Mean, Sd) UCL	81157	99% Chebyshev(Mean, Sd) UCL	110514

Suggested UCL to Use

95% H-UCL 48724

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	12
Minimum	15	Mean	1745
Maximum	17700	Median	220
SD	4483	Std. Error of Mean	1157
Coefficient of Variation	2.568	Skewness	3.677

Normal GOF Test

Shapiro Wilk Test Statistic	0.417	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.393	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3784	95% Adjusted-CLT UCL (Chen-1995)	4824
		95% Modified-t UCL (Johnson-1978)	3967

Gamma GOF Test

A-D Test Statistic	0.834	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.826	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.18	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.239	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.343	k star (bias corrected MLE)	0.319
Theta hat (MLE)	5083	Theta star (bias corrected MLE)	5469
nu hat (MLE)	10.3	nu star (bias corrected)	9.575
MLE Mean (bias corrected)	1745	MLE Sd (bias corrected)	3090
		Approximate Chi Square Value (0.05)	3.678
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	3.241

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	4544	95% Adjusted Gamma UCL (use when n<50)	5157

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.141	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.708	Mean of logged Data	5.501
Maximum of Logged Data	9.781	SD of logged Data	2.143

Assuming Lognormal Distribution

95% H-UCL	38972	90% Chebyshev (MVUE) UCL	4849
95% Chebyshev (MVUE) UCL	6288	97.5% Chebyshev (MVUE) UCL	8285
99% Chebyshev (MVUE) UCL	12208		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3649	95% Jackknife UCL	3784
95% Standard Bootstrap UCL	3531	95% Bootstrap-t UCL	11901
95% Hall's Bootstrap UCL	10183	95% Percentile Bootstrap UCL	3955
95% BCA Bootstrap UCL	5204		
90% Chebyshev(Mean, Sd) UCL	5218	95% Chebyshev(Mean, Sd) UCL	6791
97.5% Chebyshev(Mean, Sd) UCL	8974	99% Chebyshev(Mean, Sd) UCL	13262

Suggested UCL to Use

95% Adjusted Gamma UCL	5157

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	3	Number of Distinct Observations	3
		Number of Missing Observations	9
Minimum	18	Mean	1206
Maximum	2000	Median	1600
SD	1048	Std. Error of Mean	605.1
Coefficient of Variation	0.869	Skewness	-1.453

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.313	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2973	95% Adjusted-CLT UCL (Chen-1995)	1659
		95% Modified-t UCL (Johnson-1978)	2888

Gamma GOF Test
Not Enough Data to Perform GOF Test

Gamma Statistics

k hat (MLE)	0.55	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2194	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.298	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
		Approximate Chi Square Value (0.05)	N/A
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	N/A	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.37	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.89	Mean of logged Data	5.956
Maximum of Logged Data	7.601	SD of logged Data	2.658

Assuming Lognormal Distribution

95% H-UCL	3.034E+32	90% Chebyshev (MVUE) UCL	7362
95% Chebyshev (MVUE) UCL	9794	97.5% Chebyshev (MVUE) UCL	13169
99% Chebyshev (MVUE) UCL	19800		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2201	95% Jackknife UCL	2973
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	3021	95% Chebyshev(Mean, Sd) UCL	3844
97.5% Chebyshev(Mean, Sd) UCL	4985	99% Chebyshev(Mean, Sd) UCL	7227

Suggested UCL to Use

95% Student's-t UCL	2973

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction

General Statistics

Total Number of Observations	3	Number of Distinct Observations	3
		Number of Missing Observations	9
Minimum	26	Mean	1575
Maximum	2700	Median	2000
SD	1387	Std. Error of Mean	800.6
Coefficient of Variation	0.88	Skewness	-1.249

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.287	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3913	95% Adjusted-CLT UCL (Chen-1995)	2275
		95% Modified-t UCL (Johnson-1978)	3817

Gamma GOF Test
Not Enough Data to Perform GOF Test

Gamma Statistics

k hat (MLE)	0.563	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2800	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.375	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
		Approximate Chi Square Value (0.05)	N/A
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	N/A	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.365	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.258	Mean of logged Data	6.253
Maximum of Logged Data	7.901	SD of logged Data	2.598

Assuming Lognormal Distribution

95% H-UCL	1.959E+31	90% Chebyshev (MVUE) UCL	9325
95% Chebyshev (MVUE) UCL	12399	97.5% Chebyshev (MVUE) UCL	16667
99% Chebyshev (MVUE) UCL	25049		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2892	95% Jackknife UCL	3913
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	3977	95% Chebyshev(Mean, Sd) UCL	5065
97.5% Chebyshev(Mean, Sd) UCL	6575	99% Chebyshev(Mean, Sd) UCL	9541

Suggested UCL to Use

95% Student's-t UCL	3913

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	3	Number of Distinct Observations	3
		Number of Missing Observations	9
Minimum	19	Mean	1306
Maximum	2200	Median	1700
SD	1143	Std. Error of Mean	659.7
Coefficient of Variation	0.875	Skewness	-1.366

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.301	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3233	95% Adjusted-CLT UCL (Chen-1995)	1835
		95% Modified-t UCL (Johnson-1978)	3146

Gamma GOF Test
Not Enough Data to Perform GOF Test

Gamma Statistics

k hat (MLE)	0.546	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2394	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.274	nu star (bias corrected)	N/A
MLE Mean (bias corrected)	N/A	MLE Sd (bias corrected)	N/A
		Approximate Chi Square Value (0.05)	N/A
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	N/A	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.791	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.767	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.368	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.425	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.944	Mean of logged Data	6.026
Maximum of Logged Data	7.696	SD of logged Data	2.672

Assuming Lognormal Distribution

95% H-UCL	6.935E+32	90% Chebyshev (MVUE) UCL	8014
95% Chebyshev (MVUE) UCL	10663	97.5% Chebyshev (MVUE) UCL	14339
99% Chebyshev (MVUE) UCL	21560		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2391	95% Jackknife UCL	3233
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	3285	95% Chebyshev(Mean, Sd) UCL	4182
97.5% Chebyshev(Mean, Sd) UCL	5426	99% Chebyshev(Mean, Sd) UCL	7870

Suggested UCL to Use

95% Student's-t UCL	3233

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	12
Minimum	34	Mean	448.9
Maximum	1100	Median	405
SD	267.6	Std. Error of Mean	69.08
Coefficient of Variation	0.596	Skewness	0.879

Normal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	570.6	95% Adjusted-CLT UCL (Chen-1995)	579.3
		95% Modified-t UCL (Johnson-1978)	573.2

Gamma GOF Test

A-D Test Statistic	0.88	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.277	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.224	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.107	k star (bias corrected MLE)	1.73
Theta hat (MLE)	213	Theta star (bias corrected MLE)	259.4
nu hat (MLE)	63.22	nu star (bias corrected)	51.91
MLE Mean (bias corrected)	448.9	MLE Sd (bias corrected)	341.3
		Approximate Chi Square Value (0.05)	36.36
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	34.76

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	640.8	95% Adjusted Gamma UCL (use when n<50)	670.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.791	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.33	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.526	Mean of logged Data	5.851
Maximum of Logged Data	7.003	SD of logged Data	0.899

Assuming Lognormal Distribution

95% H-UCL	969.6	90% Chebyshev (MVUE) UCL	880.6
95% Chebyshev (MVUE) UCL	1052	97.5% Chebyshev (MVUE) UCL	1289
99% Chebyshev (MVUE) UCL	1756		

Nonparametric Distribution Free UCL Statistics

Data appear to follow a Discernible Distribution at 5% Significance Level

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCLs

95% CLT UCL	562.5	95% Jackknife UCL	570.6
95% Standard Bootstrap UCL	557.2	95% Bootstrap-t UCL	598.7
95% Hall's Bootstrap UCL	666.6	95% Percentile Bootstrap UCL	566.3
95% BCA Bootstrap UCL	561.1		
90% Chebyshev(Mean, Sd) UCL	656.1	95% Chebyshev(Mean, Sd) UCL	750
97.5% Chebyshev(Mean, Sd) UCL	880.3	99% Chebyshev(Mean, Sd) UCL	1136

Suggested UCL to Use

95% Student's-t UCL	570.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	12
Number of Detects	13	Number of Non-Detects	2
Number of Distinct Detects	12	Number of Distinct Non-Detects	2
Minimum Detect	0.021	Minimum Non-Detect	0.019
Maximum Detect	3.2	Maximum Non-Detect	0.024
Variance Detects	0.736	Percent Non-Detects	13.33%
Mean Detects	0.509	SD Detects	0.858
Median Detects	0.22	CV Detects	1.684
Skewness Detects	2.988	Kurtosis Detects	9.502
Mean of Logged Detects	-1.529	SD of Logged Detects	1.341

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.57	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.343	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.444	KM Standard Error of Mean	0.211
KM SD	0.785	95% KM (BCA) UCL	0.866
95% KM (t) UCL	0.816	95% KM (Percentile Bootstrap) UCL	0.817
95% KM (z) UCL	0.791	95% KM Bootstrap t UCL	1.755
90% KM Chebyshev UCL	1.077	95% KM Chebyshev UCL	1.364
97.5% KM Chebyshev UCL	1.762	99% KM Chebyshev UCL	2.543

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.605	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.774	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.224	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.247	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.706	k star (bias corrected MLE)	0.594
Theta hat (MLE)	0.722	Theta star (bias corrected MLE)	0.857
nu hat (MLE)	18.36	nu star (bias corrected)	15.46
Mean (detects)	0.509		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.443
Maximum	3.2	Median	0.19
SD	0.813	CV	1.836
k hat (MLE)	0.556	k star (bias corrected MLE)	0.489
Theta hat (MLE)	0.797	Theta star (bias corrected MLE)	0.906
nu hat (MLE)	16.67	nu star (bias corrected)	14.67
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (14.67, α)	7.031	Adjusted Chi Square Value (14.67, β)	6.39
95% Gamma Approximate UCL (use when n>=50)	0.924	95% Gamma Adjusted UCL (use when n<50)	1.017

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.444	SD (KM)	0.785
Variance (KM)	0.616	SE of Mean (KM)	0.211
k hat (KM)	0.32	k star (KM)	0.301
nu hat (KM)	9.603	nu star (KM)	9.016
theta hat (KM)	1.388	theta star (KM)	1.478
80% gamma percentile (KM)	0.681	90% gamma percentile (KM)	1.31
95% gamma percentile (KM)	2.031	99% gamma percentile (KM)	3.904

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.02, α)	3.336	Adjusted Chi Square Value (9.02, β)	2.924
95% Gamma Approximate KM-UCL (use when n>=50)	1.2	95% Gamma Adjusted KM-UCL (use when n<50)	1.369

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.153	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.443	Mean in Log Scale	-1.927
SD in Original Scale	0.813	SD in Log Scale	1.63
95% t UCL (assumes normality of ROS data)	0.813	95% Percentile Bootstrap UCL	0.805
95% BCA Bootstrap UCL	1.087	95% Bootstrap t UCL	1.761
95% H-UCL (Log ROS)	2.949		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.85	KM Geo Mean	0.157
KM SD (logged)	1.453	95% Critical H Value (KM-Log)	3.525
KM Standard Error of Mean (logged)	0.39	95% H-UCL (KM -Log)	1.774
KM SD (logged)	1.453	95% Critical H Value (KM-Log)	3.525
KM Standard Error of Mean (logged)	0.39		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.443	Mean in Log Scale	-1.931
SD in Original Scale	0.813	SD in Log Scale	1.633
95% t UCL (Assumes normality)	0.813	95% H-Stat UCL	2.964

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	1.369

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Number of Detects	14	Number of Non-Detects	1
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	0.075	Minimum Non-Detect	3.7
Maximum Detect	1.3	Maximum Non-Detect	3.7
Variance Detects	0.0967	Percent Non-Detects	6.667%
Mean Detects	0.339	SD Detects	0.311
Median Detects	0.265	CV Detects	0.918
Skewness Detects	2.588	Kurtosis Detects	7.581
Mean of Logged Detects	-1.35	SD of Logged Detects	0.728

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.691	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.343	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.339	KM Standard Error of Mean	0.0831
KM SD	0.3	95% KM (BCA) UCL	0.508
95% KM (t) UCL	0.485	95% KM (Percentile Bootstrap) UCL	0.479
95% KM (z) UCL	0.476	95% KM Bootstrap t UCL	0.688
90% KM Chebyshev UCL	0.588	95% KM Chebyshev UCL	0.701
97.5% KM Chebyshev UCL	0.858	99% KM Chebyshev UCL	1.166

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.566	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.246	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.232	Detected Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.016	k star (bias corrected MLE)	1.631
Theta hat (MLE)	0.168	Theta star (bias corrected MLE)	0.208
nu hat (MLE)	56.44	nu star (bias corrected)	45.68
Mean (detects)	0.339		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.075	Mean	0.335
Maximum	1.3	Median	0.27
SD	0.3	CV	0.894
k hat (MLE)	2.143	k star (bias corrected MLE)	1.759
Theta hat (MLE)	0.157	Theta star (bias corrected MLE)	0.191
nu hat (MLE)	64.29	nu star (bias corrected)	52.76
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (52.76, α)	37.08	Adjusted Chi Square Value (52.76, β)	35.46
95% Gamma Approximate UCL (use when n>=50)	0.477	95% Gamma Adjusted UCL (use when n<50)	0.499

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.339	SD (KM)	0.3
Variance (KM)	0.0898	SE of Mean (KM)	0.0831
k hat (KM)	1.279	k star (KM)	1.068
nu hat (KM)	38.38	nu star (KM)	32.04
theta hat (KM)	0.265	theta star (KM)	0.317
80% gamma percentile (KM)	0.543	90% gamma percentile (KM)	0.768
95% gamma percentile (KM)	0.992	99% gamma percentile (KM)	1.511

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (32.04, α)	20.1	Adjusted Chi Square Value (32.04, β)	18.94
95% Gamma Approximate KM-UCL (use when n>=50)	0.54	95% Gamma Adjusted KM-UCL (use when n<50)	0.573

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.334	Mean in Log Scale	-1.35
SD in Original Scale	0.3	SD in Log Scale	0.702
95% t UCL (assumes normality of ROS data)	0.47	95% Percentile Bootstrap UCL	0.473
95% BCA Bootstrap UCL	0.532	95% Bootstrap t UCL	0.684
95% H-UCL (Log ROS)	0.511		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.35	KM Geo Mean	0.259
KM SD (logged)	0.702	95% Critical H Value (KM-Log)	2.308
KM Standard Error of Mean (logged)	0.195	95% H-UCL (KM -Log)	0.511
KM SD (logged)	0.702	95% Critical H Value (KM-Log)	2.308
KM Standard Error of Mean (logged)	0.195		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.44	Mean in Log Scale	-1.219
SD in Original Scale	0.492	SD in Log Scale	0.866
95% t UCL (Assumes normality)	0.663	95% H-Stat UCL	0.774

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	0.573	95% GROS Adjusted Gamma UCL	0.499

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	13
		Number of Missing Observations	12
Minimum	10	Mean	28.03
Maximum	67	Median	29
SD	15.36	Std. Error of Mean	3.966
Coefficient of Variation	0.548	Skewness	1.311

Normal GOF Test

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.223	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	35.01	95% Adjusted-CLT UCL (Chen-1995)	35.99
		95% Modified-t UCL (Johnson-1978)	35.24

Gamma GOF Test

A-D Test Statistic	0.318	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.155	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.223	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.058	k star (bias corrected MLE)	3.291
Theta hat (MLE)	6.907	Theta star (bias corrected MLE)	8.517
nu hat (MLE)	121.7	nu star (bias corrected)	98.72
MLE Mean (bias corrected)	28.03	MLE Sd (bias corrected)	15.45
		Approximate Chi Square Value (0.05)	76.8
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	74.42

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	36.03	95% Adjusted Gamma UCL (use when n<50)	37.18

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.155	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.303	Mean of logged Data	3.205
Maximum of Logged Data	4.205	SD of logged Data	0.522

Assuming Lognormal Distribution

95% H-UCL	37.82	90% Chebyshev (MVUE) UCL	39.64
95% Chebyshev (MVUE) UCL	44.93	97.5% Chebyshev (MVUE) UCL	52.27
99% Chebyshev (MVUE) UCL	66.68		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	34.55	95% Jackknife UCL	35.01
95% Standard Bootstrap UCL	34.39	95% Bootstrap-t UCL	38.18
95% Hall's Bootstrap UCL	38.82	95% Percentile Bootstrap UCL	34.49
95% BCA Bootstrap UCL	35.52		
90% Chebyshev(Mean, Sd) UCL	39.93	95% Chebyshev(Mean, Sd) UCL	45.31
97.5% Chebyshev(Mean, Sd) UCL	52.8	99% Chebyshev(Mean, Sd) UCL	67.49

Suggested UCL to Use

95% Student's-t UCL	35.01

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	12
Minimum	45	Mean	2253
Maximum	19600	Median	830
SD	4998	Std. Error of Mean	1290
Coefficient of Variation	2.218	Skewness	3.423

Normal GOF Test

Shapiro Wilk Test Statistic	0.472	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.411	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4526	95% Adjusted-CLT UCL (Chen-1995)	5594
		95% Modified-t UCL (Johnson-1978)	4716

Gamma GOF Test

A-D Test Statistic	0.855	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.805	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.236	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.441	k star (bias corrected MLE)	0.398
Theta hat (MLE)	5105	Theta star (bias corrected MLE)	5668
nu hat (MLE)	13.24	nu star (bias corrected)	11.93
MLE Mean (bias corrected)	2253	MLE Sd (bias corrected)	3574
		Approximate Chi Square Value (0.05)	5.178
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	4.642

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	5189	95% Adjusted Gamma UCL (use when n<50)	5789

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.807	Mean of logged Data	6.252
Maximum of Logged Data	9.883	SD of logged Data	1.816

Assuming Lognormal Distribution

95% H-UCL	20779	90% Chebyshev (MVUE) UCL	5609
95% Chebyshev (MVUE) UCL	7180	97.5% Chebyshev (MVUE) UCL	9360
99% Chebyshev (MVUE) UCL	13643		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4376	95% Jackknife UCL	4526
95% Standard Bootstrap UCL	4261	95% Bootstrap-t UCL	16182
95% Hall's Bootstrap UCL	14293	95% Percentile Bootstrap UCL	4594
95% BCA Bootstrap UCL	5976		
90% Chebyshev(Mean, Sd) UCL	6124	95% Chebyshev(Mean, Sd) UCL	7878
97.5% Chebyshev(Mean, Sd) UCL	10312	99% Chebyshev(Mean, Sd) UCL	15092

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	15092

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1232 (PCB-1232)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	13
		Number of Missing Observations	12
Number of Detects	1	Number of Non-Detects	14
Number of Distinct Detects	1	Number of Distinct Non-Detects	12

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1232 (PCB-1232) was not processed!

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	12
		Number of Missing Observations	12
Number of Detects	2	Number of Non-Detects	13
Number of Distinct Detects	2	Number of Distinct Non-Detects	10
Minimum Detect	230	Minimum Non-Detect	19
Maximum Detect	1100	Maximum Non-Detect	220
Variance Detects	378450	Percent Non-Detects	86.67%
Mean Detects	665	SD Detects	615.2
Median Detects	665	CV Detects	0.925
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	6.221	SD of Logged Detects	1.107

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	105.1	KM Standard Error of Mean	98.96
KM SD	271	95% KM (BCA) UCL	N/A
95% KM (t) UCL	279.4	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	267.9	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	402	95% KM Chebyshev UCL	536.5
97.5% KM Chebyshev UCL	723.2	99% KM Chebyshev UCL	1090

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.941	k star (bias corrected MLE)	N/A
Theta hat (MLE)	342.6	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	7.763	nu star (bias corrected)	N/A
Mean (detects)	665		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	105.1	SD (KM)	271
Variance (KM)	73453	SE of Mean (KM)	98.96
k hat (KM)	0.15	k star (KM)	0.165
nu hat (KM)	4.514	nu star (KM)	4.945
theta hat (KM)	698.7	theta star (KM)	637.8
80% gamma percentile (KM)	123	90% gamma percentile (KM)	315.1
95% gamma percentile (KM)	567.5	99% gamma percentile (KM)	1286

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0324
Approximate Chi Square Value (4.94, α)	1.127	Adjusted Chi Square Value (4.94, β)	0.922
95% Gamma Approximate KM-UCL (use when n>=50)	461.4	95% Gamma Adjusted KM-UCL (use when n<50)	563.9

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	89.09	Mean in Log Scale	-0.292
SD in Original Scale	285.8	SD in Log Scale	2.875
95% t UCL (assumes normality of ROS data)	219.1	95% Percentile Bootstrap UCL	235.6
95% BCA Bootstrap UCL	309.1	95% Bootstrap t UCL	49880
95% H-UCL (Log ROS)	5976		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242) (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.381	KM Geo Mean	29.41
KM SD (logged)	1.15	95% Critical H Value (KM-Log)	2.99
KM Standard Error of Mean (logged)	0.42	95% H-UCL (KM -Log)	142.7
KM SD (logged)	1.15	95% Critical H Value (KM-Log)	2.99
KM Standard Error of Mean (logged)	0.42		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	112	Mean in Log Scale	3.289
SD in Original Scale	280.1	SD in Log Scale	1.454
95% t UCL (Assumes normality)	239.4	95% H-Stat UCL	303.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	536.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	12
		Number of Missing Observations	12
Number of Detects	2	Number of Non-Detects	13
Number of Distinct Detects	2	Number of Distinct Non-Detects	10
Minimum Detect	1600	Minimum Non-Detect	24
Maximum Detect	8600	Maximum Non-Detect	260
Variance Detects	24500000	Percent Non-Detects	86.67%
Mean Detects	5100	SD Detects	4950
Median Detects	5100	CV Detects	0.971
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	8.219	SD of Logged Detects	1.189

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	700.8	KM Standard Error of Mean	784.1
KM SD	2147	95% KM (BCA) UCL	N/A
95% KM (t) UCL	2082	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1990	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	3053	95% KM Chebyshev UCL	4118
97.5% KM Chebyshev UCL	5597	99% KM Chebyshev UCL	8502

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.718	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2968	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	6.873	nu star (bias corrected)	N/A
Mean (detects)	5100		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	700.8	SD (KM)	2147
Variance (KM)	4610712	SE of Mean (KM)	784.1
k hat (KM)	0.107	k star (KM)	0.13
nu hat (KM)	3.196	nu star (KM)	3.89
theta hat (KM)	6579	theta star (KM)	5405
80% gamma percentile (KM)	667.7	90% gamma percentile (KM)	2024
95% gamma percentile (KM)	3956	99% gamma percentile (KM)	9743

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0324
Approximate Chi Square Value (3.89, α)	0.679	Adjusted Chi Square Value (3.89, β)	0.536
95% Gamma Approximate KM-UCL (use when n>=50)	4017	95% Gamma Adjusted KM-UCL (use when n<50)	5084

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	681.9	Mean in Log Scale	1.221
SD in Original Scale	2229	SD in Log Scale	3.09
95% t UCL (assumes normality of ROS data)	1696	95% Percentile Bootstrap UCL	1722
95% BCA Bootstrap UCL	2508	95% Bootstrap t UCL	626663
95% H-UCL (Log ROS)	105772		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248) (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.85	KM Geo Mean	47
KM SD (logged)	1.741	95% Critical H Value (KM-Log)	4.063
KM Standard Error of Mean (logged)	0.636	95% H-UCL (KM -Log)	1416
KM SD (logged)	1.741	95% Critical H Value (KM-Log)	4.063
KM Standard Error of Mean (logged)	0.636		

DL/2 Statistics

DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	710	Mean in Log Scale	3.806
SD in Original Scale	2220	SD in Log Scale	1.983
95% t UCL (Assumes normality)	1720	95% H-Stat UCL	3540

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	4118

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	13
		Number of Missing Observations	12
Number of Detects	5	Number of Non-Detects	10
Number of Distinct Detects	5	Number of Distinct Non-Detects	8
Minimum Detect	86	Minimum Non-Detect	22
Maximum Detect	1800	Maximum Non-Detect	160
Variance Detects	486097	Percent Non-Detects	66.67%
Mean Detects	601.2	SD Detects	697.2
Median Detects	410	CV Detects	1.16
Skewness Detects	1.828	Kurtosis Detects	3.525
Mean of Logged Detects	5.861	SD of Logged Detects	1.185

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.788	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.324	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	216.2	KM Standard Error of Mean	130.4
KM SD	451.5	95% KM (BCA) UCL	437.9
95% KM (t) UCL	445.9	95% KM (Percentile Bootstrap) UCL	443.6
95% KM (z) UCL	430.7	95% KM Bootstrap t UCL	648.7
90% KM Chebyshev UCL	607.3	95% KM Chebyshev UCL	784.5
97.5% KM Chebyshev UCL	1030	99% KM Chebyshev UCL	1513

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.274	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.691	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.364	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.065	k star (bias corrected MLE)	0.559
Theta hat (MLE)	564.4	Theta star (bias corrected MLE)	1075
nu hat (MLE)	10.65	nu star (bias corrected)	5.594
Mean (detects)	601.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	200.4
Maximum	1800	Median	0.01
SD	474.3	CV	2.367
k hat (MLE)	0.123	k star (bias corrected MLE)	0.143
Theta hat (MLE)	1627	Theta star (bias corrected MLE)	1402
nu hat (MLE)	3.695	nu star (bias corrected)	4.289
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (4.29, α)	0.839	Adjusted Chi Square Value (4.29, β)	0.673
95% Gamma Approximate UCL (use when n>=50)	1024	95% Gamma Adjusted UCL (use when n<50)	1278

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	216.2	SD (KM)	451.5
Variance (KM)	203849	SE of Mean (KM)	130.4
k hat (KM)	0.229	k star (KM)	0.228
nu hat (KM)	6.881	nu star (KM)	6.838
theta hat (KM)	942.7	theta star (KM)	948.6
80% gamma percentile (KM)	303	90% gamma percentile (KM)	652.4
95% gamma percentile (KM)	1075	99% gamma percentile (KM)	2216

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.84, α)	2.082	Adjusted Chi Square Value (6.84, β)	1.775
95% Gamma Approximate KM-UCL (use when n>=50)	710.1	95% Gamma Adjusted KM-UCL (use when n<50)	833.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	206.1	Mean in Log Scale	3.296
SD in Original Scale	471.7	SD in Log Scale	2.033
95% t UCL (assumes normality of ROS data)	420.6	95% Percentile Bootstrap UCL	441.9
95% BCA Bootstrap UCL	550	95% Bootstrap t UCL	909.6
95% H-UCL (Log ROS)	2633		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.034	KM Geo Mean	56.5
KM SD (logged)	1.441	95% Critical H Value (KM-Log)	3.503
KM Standard Error of Mean (logged)	0.419	95% H-UCL (KM -Log)	614.6
KM SD (logged)	1.441	95% Critical H Value (KM-Log)	3.503
KM Standard Error of Mean (logged)	0.419		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	214.4	Mean in Log Scale	3.834
SD in Original Scale	468.3	SD in Log Scale	1.682
95% t UCL (Assumes normality)	427.4	95% H-Stat UCL	1124

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	445.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	12
Number of Detects	4	Number of Non-Detects	11
Number of Distinct Detects	4	Number of Distinct Non-Detects	11
Minimum Detect	44	Minimum Non-Detect	22
Maximum Detect	770	Maximum Non-Detect	240
Variance Detects	111564	Percent Non-Detects	73.33%
Mean Detects	381	SD Detects	334
Median Detects	355	CV Detects	0.877
Skewness Detects	0.272	Kurtosis Detects	-3.211
Mean of Logged Detects	5.464	SD of Logged Detects	1.293

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.236	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	119.3	KM Standard Error of Mean	64.97
KM SD	217.6	95% KM (BCA) UCL	N/A
95% KM (t) UCL	233.7	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	226.1	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	314.2	95% KM Chebyshev UCL	402.5
97.5% KM Chebyshev UCL	525	99% KM Chebyshev UCL	765.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.276	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.665	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.259	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.401	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.184	k star (bias corrected MLE)	0.463
Theta hat (MLE)	321.7	Theta star (bias corrected MLE)	823.4
nu hat (MLE)	9.474	nu star (bias corrected)	3.702
Mean (detects)	381		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	101.6
Maximum	770	Median	0.01
SD	233.1	CV	2.294
k hat (MLE)	0.121	k star (bias corrected MLE)	0.141
Theta hat (MLE)	839.1	Theta star (bias corrected MLE)	719
nu hat (MLE)	3.633	nu star (bias corrected)	4.239
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (4.24, α)	0.819	Adjusted Chi Square Value (4.24, β)	0.655
95% Gamma Approximate UCL (use when n>=50)	526.3	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	119.3	SD (KM)	217.6
Variance (KM)	47356	SE of Mean (KM)	64.97
k hat (KM)	0.3	k star (KM)	0.285
nu hat (KM)	9.012	nu star (KM)	8.543
theta hat (KM)	397	theta star (KM)	418.8
80% gamma percentile (KM)	180.5	90% gamma percentile (KM)	353.9
95% gamma percentile (KM)	554.7	99% gamma percentile (KM)	1080

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.54, α)	3.053	Adjusted Chi Square Value (8.54, β)	2.663
95% Gamma Approximate KM-UCL (use when n>=50)	333.7	95% Gamma Adjusted KM-UCL (use when n<50)	382.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.239	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	104.5	Mean in Log Scale	2.443
SD in Original Scale	231.7	SD in Log Scale	1.988
95% t UCL (assumes normality of ROS data)	209.9	95% Percentile Bootstrap UCL	210.7
95% BCA Bootstrap UCL	228.7	95% Bootstrap t UCL	587.8
95% H-UCL (Log ROS)	925.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.758	KM Geo Mean	42.86
KM SD (logged)	1.196	95% Critical H Value (KM-Log)	3.069
KM Standard Error of Mean (logged)	0.362	95% H-UCL (KM -Log)	233.7
KM SD (logged)	1.196	95% Critical H Value (KM-Log)	3.069
KM Standard Error of Mean (logged)	0.362		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	127.7	Mean in Log Scale	3.765
SD in Original Scale	223.5	SD in Log Scale	1.435
95% t UCL (Assumes normality)	229.3	95% H-Stat UCL	461.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	233.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0)

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	23
Minimum	0.0669	Mean	19.41
Maximum	74.54	Median	1.512
SD	36.78	Std. Error of Mean	18.39
Coefficient of Variation	1.895	Skewness	1.992

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.657	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.423	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	62.68	95% Adjusted-CLT UCL (Chen-1995)	69.23
		95% Modified-t UCL (Johnson-1978)	65.74

Gamma GOF Test

A-D Test Statistic	0.435	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.287	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.422	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.249	k star (bias corrected MLE)	0.229
Theta hat (MLE)	78.06	Theta star (bias corrected MLE)	84.81
nu hat (MLE)	1.989	nu star (bias corrected)	1.831
MLE Mean (bias corrected)	19.41	MLE Sd (bias corrected)	40.57
		Approximate Chi Square Value (0.05)	0.132
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	269.4	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.265	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.705	Mean of logged Data	0.106
Maximum of Logged Data	4.311	SD of logged Data	3.27

Assuming Lognormal Distribution

95% H-UCL	7.523E+19	90% Chebyshev (MVUE) UCL	58
95% Chebyshev (MVUE) UCL	77.34	97.5% Chebyshev (MVUE) UCL	104.2
99% Chebyshev (MVUE) UCL	156.9		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	49.66	95% Jackknife UCL	62.68
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	74.58	95% Chebyshev(Mean, Sd) UCL	99.56
97.5% Chebyshev(Mean, Sd) UCL	134.2	99% Chebyshev(Mean, Sd) UCL	202.4

Suggested UCL to Use

95% Adjusted Gamma UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0.5)

General Statistics

Total Number of Observations	4	Number of Distinct Observations	4
		Number of Missing Observations	23
Minimum	0.595	Mean	19.77
Maximum	74.73	Median	1.885
SD	36.66	Std. Error of Mean	18.33
Coefficient of Variation	1.854	Skewness	1.994

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.654	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.425	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	62.91	95% Adjusted-CLT UCL (Chen-1995)	69.44
		95% Modified-t UCL (Johnson-1978)	65.95

Gamma GOF Test

A-D Test Statistic	0.59	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.697	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.356	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.416	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.36	k star (bias corrected MLE)	0.257
Theta hat (MLE)	54.89	Theta star (bias corrected MLE)	77.02
nu hat (MLE)	2.882	nu star (bias corrected)	2.054
MLE Mean (bias corrected)	19.77	MLE Sd (bias corrected)	39.03
		Approximate Chi Square Value (0.05)	0.158
Adjusted Level of Significance	N/A	Adjusted Chi Square Value	N/A

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	256.9	95% Adjusted Gamma UCL (use when n<50)	N/A

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.748	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.254	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.375	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.52	Mean of logged Data	1.127
Maximum of Logged Data	4.314	SD of logged Data	2.257

Assuming Lognormal Distribution

95% H-UCL	8.979E+9	90% Chebyshev (MVUE) UCL	46.27
95% Chebyshev (MVUE) UCL	61.15	97.5% Chebyshev (MVUE) UCL	81.8
99% Chebyshev (MVUE) UCL	122.4		

Table B.13.4

Summary of ProUCL Output for EU15 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/6/2019 4:00:35 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0.5) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	49.92	95% Jackknife UCL	62.91
95% Standard Bootstrap UCL	N/A	95% Bootstrap-t UCL	N/A
95% Hall's Bootstrap UCL	N/A	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A		
90% Chebyshev(Mean, Sd) UCL	74.76	95% Chebyshev(Mean, Sd) UCL	99.66
97.5% Chebyshev(Mean, Sd) UCL	134.2	99% Chebyshev(Mean, Sd) UCL	202.1

Suggested UCL to Use

95% Adjusted Gamma UCL	N/A

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.1

Summary of ProUCL Input Data for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Chlorobenzene	D_Chlorobenzene	Ethylbenzene	D_Ethylbenzene	Tetrachloroethene	D_Tetrachloroethene	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride
on-site (EU16)	BH08-09	6/20/2009	3-5 ft BGS	0.46	1	6	0	6	0	6	0	6	0	54	1
on-site (EU16)	BH34-13	6/27/2013	4-6 ft BGS	5	0	5	0	6.9	1	5	0	5	0	5	0
on-site (EU16)	BH36-13	7/1/2013	0-2 ft BGS	4.9	0	4.9	0	4.9	0	4.9	0	4.9	0	4.9	0
on-site (EU16)	BH38-13	6/27/2013	2-4 ft BGS	280	1	23	1	15000	1	570	0	1600	1	200	1
on-site (EU16)	BH42-13	7/1/2013	2-4 ft BGS	3050	0	3050	0	8150	1	320	1	3050	0	3050	0
on-site (EU16)	BH44-13	7/1/2013	2-4 ft BGS	230	0	230	0	8.6	1	230	0	230	0	230	0
on-site (EU16)	BH136-18	1/8/2018	1-3 ft BGS	31.5	0	30.5	0	35.5	0	21.5	0	85.5	1	83.5	1
on-site (EU16)	BH137-18	1/8/2018	13-15 ft BGS	79	0	76	0	89	0	1300	1	11000	1	43	0
on-site (EU16)	BH138-18	1/9/2018	8-10 ft BGS	0.48	0	0.48	0	0.39	0	0.54	0	0.6	0	0.41	0
on-site (EU16)	BH139-18	1/4/2018	13-15 ft BGS	180	0	180	0	210	0	40000	1	25000	1	100	0
on-site (EU16)	BH140-18	1/8/2018	13-15 ft BGS	1.1	1	0.45	0	0.37	0	1.5	1	15	1	3	1
on-site (EU16)	BH141-18	1/9/2018	6-8 ft BGS	94	0	26000	1	270	1	63	0	430	1	51	0
on-site (EU16)	BH142-18	1/4/2018	8-10 ft BGS	0.34	0	0.34	0	0.28	0	0.39	0	0.75	1	0.29	0
on-site (EU16)	GP01-18	1/25/2018	5.5-6.5 ft bgs	590	0	100000	1	670	0	400	0	700	0	320	0
on-site (EU16)	GP32-18	1/10/2018	10-11 ft BGS	0.43	0	0.43	0	0.35	0	0.48	0	1.5	1	0.36	0
on-site (EU16)	TP-5	10/6/2008	12 ft BGS	300	0					300	0	16	1	300	0
on-site (EU16)	TP-5	10/6/2008	12 ft BGS			9800	1	2400	1						
on-site (EU16)	TP-5	10/6/2008	8 ft BGS												
on-site (EU16)	TP-6	10/6/2008	11 ft BGS	7.3	0	7.3	0	7.3	0	7.3	0	7.3	0	7.3	0
on-site (EU16)	TP-6	10/6/2008	11 ft BGS												
on-site (EU16)	TT-7	10/7/2008	6 ft BGS	1800	0			220	1	1800	0	1800	0	1800	0
on-site (EU16)	TT-7	10/7/2008	6 ft BGS			47000	1								
on-site (EU16)	TT-21	10/8/2008	8 ft BGS	320	0	14	1			320	0			130	1
on-site (EU16)	TT-21	10/8/2008	8 ft BGS					2500	1			400	1		
on-site (EU16)	TT-22	10/8/2008	6 ft BGS	1800	0	1800	0			1800	0	1800	0	1800	0
on-site (EU16)	TT-22	10/8/2008	6 ft BGS					54000	1						
on-site (EU16)	TT-24	3/20/2018	13-15 ft BGS	1300	0	1300	0	210000	1	910		1600	0	730	0
on-site (EU16)	TT-24	3/20/2018	2-4 ft bgs	0.36	0	0.36	0	6.8	1	0.56	1	0.51	1	0.3	0
on-site (EU16)	VAS-5	12/15/2008	7 ft BGS												

Table B.14.1

Summary of ProUCL Input Data for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				12	13	14	15	16	17	18	19	20	21	22	23
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Xylenes (total)	D_Xylenes (total)	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Naphthalene	D_Naphthalene
on-site (EU16)	BH08-09	6/20/2009	3-5 ft BGS	1.9	1	11	1	8	0	9	1	8	0	44	1
on-site (EU16)	BH34-13	6/27/2013	4-6 ft BGS	27	1										
on-site (EU16)	BH36-13	7/1/2013	0-2 ft BGS	9.8	0										
on-site (EU16)	BH38-13	6/27/2013	2-4 ft BGS	14000	1										
on-site (EU16)	BH42-13	7/1/2013	2-4 ft BGS	18500	1										
on-site (EU16)	BH44-13	7/1/2013	2-4 ft BGS	450											
on-site (EU16)	BH136-18	1/8/2018	1-3 ft BGS	52.5	1	390	1	575	1	1260	1	305	1	290	1
on-site (EU16)	BH137-18	1/8/2018	13-15 ft BGS	71	0	330	1	250	1	530	1	76	1	670	1
on-site (EU16)	BH138-18	1/9/2018	8-10 ft BGS	0.58	0	23	1	31	1	52	1	13	1	50	1
on-site (EU16)	BH139-18	1/4/2018	13-15 ft BGS	170	0	16	0	16	0	15	0	8.7	0	240	1
on-site (EU16)	BH140-18	1/8/2018	13-15 ft BGS	0.55	0	52	1	36	1	96	1	0.89	0	25	1
on-site (EU16)	BH141-18	1/9/2018	6-8 ft BGS	720	1	41	1	1.1	0	60	1	0.6	0	1500	1
on-site (EU16)	BH142-18	1/4/2018	8-10 ft BGS	0.42	0	430	1	34	0	660	1	19	0	44	0
on-site (EU16)	GP01-18	1/25/2018	5.5-6.5 ft bgs	530	0										
on-site (EU16)	GP32-18	1/10/2018	10-11 ft BGS	0.52	0										
on-site (EU16)	TP-5	10/6/2008	12 ft BGS			170	0	170	0	170	0	170	0		
on-site (EU16)	TP-5	10/6/2008	12 ft BGS	12000	1									5500	1
on-site (EU16)	TP-5	10/6/2008	8 ft BGS												
on-site (EU16)	TP-6	10/6/2008	11 ft BGS	15	0	8.2	0	8.2	0	8.2	0	8.2	0	8.2	0
on-site (EU16)	TP-6	10/6/2008	11 ft BGS												
on-site (EU16)	TT-7	10/7/2008	6 ft BGS												
on-site (EU16)	TT-7	10/7/2008	6 ft BGS	710	1	6400	1	4500	1	6200	1	2300	1	270	1
on-site (EU16)	TT-21	10/8/2008	8 ft BGS			82	0	82	0			82	0	82	0
on-site (EU16)	TT-21	10/8/2008	8 ft BGS	3600	1					160	1				
on-site (EU16)	TT-22	10/8/2008	6 ft BGS			200	0								
on-site (EU16)	TT-22	10/8/2008	6 ft BGS	6300	1			540	1	690	1	390	1	860	1
on-site (EU16)	TT-24	3/20/2018	13-15 ft BGS	590000	1	39	0	40		37	0	22	0	9800	1
on-site (EU16)	TT-24	3/20/2018	2-4 ft bgs	23	1	220	1	270	1	470	1	190	1	14	1
on-site (EU16)	VAS-5	12/15/2008	7 ft BGS												

Table B.14.1

Summary of ProUCL Input Data for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper
on-site (EU16)	BH08-09	6/20/2009	3-5 ft BGS	3650	1	0.67	1	6.6	1	23.7	1	0.6	0	15	1	5.5	1	70.6	1
on-site (EU16)	BH34-13	6/27/2013	4-6 ft BGS																
on-site (EU16)	BH36-13	7/1/2013	0-2 ft BGS																
on-site (EU16)	BH38-13	6/27/2013	2-4 ft BGS																
on-site (EU16)	BH42-13	7/1/2013	2-4 ft BGS																
on-site (EU16)	BH44-13	7/1/2013	2-4 ft BGS																
on-site (EU16)	BH136-18	1/8/2018	1-3 ft BGS	3450	1	0.415	1	5.7	1	104.5	1	0.35	1	1	1	3.3	1	195	1
on-site (EU16)	BH137-18	1/8/2018	13-15 ft BGS	6100	1	5.3	1	19	1	1900	1	4.5	1	1.7	1	11	1	1300	1
on-site (EU16)	BH138-18	1/9/2018	8-10 ft BGS	5500	1	1.7	1	30	1	330	1	1.2	1	0.34	0	11	1	56	1
on-site (EU16)	BH139-18	1/4/2018	13-15 ft BGS	2600	1	0.49	1	11	1	6200	1	5.3	1	3	0	37	1	2700	1
on-site (EU16)	BH140-18	1/8/2018	13-15 ft BGS	19000	1	6.8	1	22	1	2200	1	29	1	1.5	0	17	1	1500	1
on-site (EU16)	BH141-18	1/9/2018	6-8 ft BGS	5500	1	2.3	1	28	1	200	1	0.48	1	1.1	1	18	1	250	1
on-site (EU16)	BH142-18	1/4/2018	8-10 ft BGS	4600	1	5.7	1	24	1	440	1	4.7	1	0.26	0	21	1	1700	1
on-site (EU16)	GP01-18	1/25/2018	5.5-6.5 ft bgs																
on-site (EU16)	GP32-18	1/10/2018	10-11 ft BGS																
on-site (EU16)	TP-5	10/6/2008	12 ft BGS											26	1				
on-site (EU16)	TP-5	10/6/2008	12 ft BGS	10700	1	12.2	1	14.2	1	7810	1	7.8	1			9.3	1	2590	1
on-site (EU16)	TP-5	10/6/2008	8 ft BGS																
on-site (EU16)	TP-6	10/6/2008	11 ft BGS											5.3	1				
on-site (EU16)	TP-6	10/6/2008	11 ft BGS	7400	1	1.7	1	11.7	1	1380	1	4.2	1			2.9	1	900	1
on-site (EU16)	TT-7	10/7/2008	6 ft BGS											9	1				
on-site (EU16)	TT-7	10/7/2008	6 ft BGS	6160	1	22.6	1	19.4	1	971	1	10.1	1			11.9	1	7340	1
on-site (EU16)	TT-21	10/8/2008	8 ft BGS																
on-site (EU16)	TT-21	10/8/2008	8 ft BGS	6080	1	4.7	1	13.6	1	622	1	2.1	1	9	1	6.1	1	209	1
on-site (EU16)	TT-22	10/8/2008	6 ft BGS																
on-site (EU16)	TT-22	10/8/2008	6 ft BGS	20700	1	191	1	13.4	1	1400	1	11.2	1	14.4	1	11.9	1	2290	1
on-site (EU16)	TT-24	3/20/2018	13-15 ft BGS	6600	1	0.61	1	13	1	320	1	0.86	1	3.3	1	9.2	1	210	1
on-site (EU16)	TT-24	3/20/2018	2-4 ft bgs	2600	1	0.5	1	7.8	1	54	1	0.53	1	1.3	1	3.2	1	29	1
on-site (EU16)	VAS-5	12/15/2008	7 ft BGS																

Table B.14.1

Summary of ProUCL Input Data for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel	Thallium	D_Thallium	Vanadium	D_Vanadium
on-site (EU16)	BH08-09	6/20/2009	3-5 ft BGS			69100		9.4		1140	1	0.12	0	42.6	1	0.12	0	11	1
on-site (EU16)	BH34-13	6/27/2013	4-6 ft BGS																
on-site (EU16)	BH36-13	7/1/2013	0-2 ft BGS																
on-site (EU16)	BH38-13	6/27/2013	2-4 ft BGS																
on-site (EU16)	BH42-13	7/1/2013	2-4 ft BGS																
on-site (EU16)	BH44-13	7/1/2013	2-4 ft BGS																
on-site (EU16)	BH136-18	1/8/2018	1-3 ft BGS	0.17	1	17000	1	150	1	295	1	0.81	1	11.5	1	0.093	1	11.5	1
on-site (EU16)	BH137-18	1/8/2018	13-15 ft BGS	0.31	1	100000	1	1100	1	320	1	0.15	1	44	1	0.14	1	14	1
on-site (EU16)	BH138-18	1/9/2018	8-10 ft BGS	0.33	1	8500	1	75	1	70	1	0.081	1	20	1	0.51	1	38	1
on-site (EU16)	BH139-18	1/4/2018	13-15 ft BGS	0.3	1	23000	1	16000	1	400	1	0.058	1	640	1	0.28	1	15	1
on-site (EU16)	BH140-18	1/8/2018	13-15 ft BGS	8.7	1	150000	1	1700	1	520	1	3.9	1	170	1	0.2	1	23	1
on-site (EU16)	BH141-18	1/9/2018	6-8 ft BGS	3.5	1	13000	1	590	1	78	1	1.1	1	36	1	2.4	1	79	1
on-site (EU16)	BH142-18	1/4/2018	8-10 ft BGS	0.12	1	210000	1	350	1	1400	1	0.76	1	860	1	0.095	1	37	1
on-site (EU16)	GP01-18	1/25/2018	5.5-6.5 ft bgs																
on-site (EU16)	GP32-18	1/10/2018	10-11 ft BGS																
on-site (EU16)	TP-5	10/6/2008	12 ft BGS							561	1					0.64	0		
on-site (EU16)	TP-5	10/6/2008	12 ft BGS	6	1	63000	1	5020	1			0.24	1	241	1			34	1
on-site (EU16)	TP-5	10/6/2008	8 ft BGS																
on-site (EU16)	TP-6	10/6/2008	11 ft BGS	0.62	0					333	1					0.12	0		
on-site (EU16)	TP-6	10/6/2008	11 ft BGS			25300	1	546	1			1.3	1	20.2	1			20.9	1
on-site (EU16)	TT-7	10/7/2008	6 ft BGS	0.64	0					557	1								
on-site (EU16)	TT-7	10/7/2008	6 ft BGS			72100	1	2380	1			2.6	1	87.9	1	0.2	1	22.1	1
on-site (EU16)	TT-21	10/8/2008	8 ft BGS													0.23	0		
on-site (EU16)	TT-21	10/8/2008	8 ft BGS	3.4	1	16800	1	604	1	291	1	0.22	1	19.3	1			26	1
on-site (EU16)	TT-22	10/8/2008	6 ft BGS													3	0		
on-site (EU16)	TT-22	10/8/2008	6 ft BGS	0.28	1	42100	1	6180	1	554	1	0.32	1	145	1			19.1	1
on-site (EU16)	TT-24	3/20/2018	13-15 ft BGS	11	1	5700	1	69	1	37	1	0.7	1	19	1	0.5	1	33	1
on-site (EU16)	TT-24	3/20/2018	2-4 ft bgs	0.15	0	7800	1	48	1	240	1	0.035	1	10	1	0.18	1	12	1
on-site (EU16)	VAS-5	12/15/2008	7 ft BGS																

Table B.14.1

Summary of ProUCL Input Data for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				56	57	58	59	60	61	62	63
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Zinc	D_Zinc	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Dieldrin	D_Dieldrin
on-site (EU16)	BH08-09	6/20/2009	3-5 ft BGS	26.9	1	40	0	40	0		
on-site (EU16)	BH34-13	6/27/2013	4-6 ft BGS								
on-site (EU16)	BH36-13	7/1/2013	0-2 ft BGS								
on-site (EU16)	BH38-13	6/27/2013	2-4 ft BGS								
on-site (EU16)	BH42-13	7/1/2013	2-4 ft BGS								
on-site (EU16)	BH44-13	7/1/2013	2-4 ft BGS			53	1	35	0		
on-site (EU16)	BH136-18	1/8/2018	1-3 ft BGS	63	1	59.5	0	1220	1	14.15	0
on-site (EU16)	BH137-18	1/8/2018	13-15 ft BGS	2200	1	400	1	2700	1	20	0
on-site (EU16)	BH138-18	1/9/2018	8-10 ft BGS	140	1	130	1	33	0	26	0
on-site (EU16)	BH139-18	1/4/2018	13-15 ft BGS	740	1	23	0	94	1	22	0
on-site (EU16)	BH140-18	1/8/2018	13-15 ft BGS	19000	1	29000	1	10000	1	55	0
on-site (EU16)	BH141-18	1/9/2018	6-8 ft BGS	80	1	33	0	40	0	30	0
on-site (EU16)	BH142-18	1/4/2018	8-10 ft BGS	1000	1	20	0	450	1	9.7	0
on-site (EU16)	GP01-18	1/25/2018	5.5-6.5 ft bgs								
on-site (EU16)	GP32-18	1/10/2018	10-11 ft BGS								
on-site (EU16)	TP-5	10/6/2008	12 ft BGS							68	1
on-site (EU16)	TP-5	10/6/2008	12 ft BGS	2390	1	10000	1	2800	1		
on-site (EU16)	TP-5	10/6/2008	8 ft BGS								
on-site (EU16)	TP-6	10/6/2008	11 ft BGS			41	0	41	0	2.1	0
on-site (EU16)	TP-6	10/6/2008	11 ft BGS	816	1						
on-site (EU16)	TT-7	10/7/2008	6 ft BGS							220	0
on-site (EU16)	TT-7	10/7/2008	6 ft BGS	1790	1	1700	1	1600	1		
on-site (EU16)	TT-21	10/8/2008	8 ft BGS			41	0			210	0
on-site (EU16)	TT-21	10/8/2008	8 ft BGS	739	1			120	1		
on-site (EU16)	TT-22	10/8/2008	6 ft BGS			50	0			260	0
on-site (EU16)	TT-22	10/8/2008	6 ft BGS	1630	1			51	1		
on-site (EU16)	TT-24	3/20/2018	13-15 ft BGS	240	1	120	0	2600	1	22	0
on-site (EU16)	TT-24	3/20/2018	2-4 ft bgs	57	1	19	0	23	0	8.9	0
on-site (EU16)	VAS-5	12/15/2008	7 ft BGS								

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	22	Number of Distinct Observations	21
		Number of Missing Observations	6
Number of Detects	3	Number of Non-Detects	19
Number of Distinct Detects	3	Number of Distinct Non-Detects	18
Minimum Detect	0.46	Minimum Non-Detect	0.34
Maximum Detect	280	Maximum Non-Detect	3050
Variance Detects	25988	Percent Non-Detects	86.36%
Mean Detects	93.85	SD Detects	161.2
Median Detects	1.1	CV Detects	1.718
Skewness Detects	1.732	Kurtosis Detects	N/A
Mean of Logged Detects	1.651	SD of Logged Detects	3.477

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.752	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.384	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	19.13	KM Standard Error of Mean	22.05
KM SD	69.72	95% KM (BCA) UCL	N/A
95% KM (t) UCL	57.07	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	55.39	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	85.27	95% KM Chebyshev UCL	115.2
97.5% KM Chebyshev UCL	156.8	99% KM Chebyshev UCL	238.5

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.246	k star (bias corrected MLE)	N/A
Theta hat (MLE)	381	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1.478	nu star (bias corrected)	N/A
Mean (detects)	93.85		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	12.81
Maximum	280	Median	0.01
SD	59.68	CV	4.66
k hat (MLE)	0.125	k star (bias corrected MLE)	0.138
Theta hat (MLE)	102.4	Theta star (bias corrected MLE)	92.56
nu hat (MLE)	5.505	nu star (bias corrected)	6.088
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (6.09, α)	1.685	Adjusted Chi Square Value (6.09, β)	1.519
95% Gamma Approximate UCL (use when n>=50)	46.27	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	19.13	SD (KM)	69.72
Variance (KM)	4861	SE of Mean (KM)	22.05
k hat (KM)	0.0752	k star (KM)	0.0953
nu hat (KM)	3.311	nu star (KM)	4.193
theta hat (KM)	254.2	theta star (KM)	200.7
80% gamma percentile (KM)	12.35	90% gamma percentile (KM)	49.84
95% gamma percentile (KM)	111.3	99% gamma percentile (KM)	311.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.19, α)	0.799	Adjusted Chi Square Value (4.19, β)	0.699
95% Gamma Approximate KM-UCL (use when n>=50)	100.3	95% Gamma Adjusted KM-UCL (use when n<50)	114.8

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.85	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.339	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	12.82	Mean in Log Scale	-3.587
SD in Original Scale	59.68	SD in Log Scale	2.619
95% t UCL (assumes normality of ROS data)	34.71	95% Percentile Bootstrap UCL	38.25
95% BCA Bootstrap UCL	51.06	95% Bootstrap t UCL	7597
95% H-UCL (Log ROS)	17.48		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.39	KM Geo Mean	0.677
KM SD (logged)	1.662	95% Critical H Value (KM-Log)	3.609
KM Standard Error of Mean (logged)	0.547	95% H-UCL (KM -Log)	9.976
KM SD (logged)	1.662	95% Critical H Value (KM-Log)	3.609
KM Standard Error of Mean (logged)	0.547		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	235.4	Mean in Log Scale	2.924
SD in Original Scale	401.7	SD in Log Scale	3.149
95% t UCL (Assumes normality)	382.7	95% H-Stat UCL	194166

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	57.07

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chlorobenzene

General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	6
Number of Detects	6	Number of Non-Detects	16
Number of Distinct Detects	6	Number of Distinct Non-Detects	16
Minimum Detect	14	Minimum Non-Detect	0.34
Maximum Detect	100000	Maximum Non-Detect	3050
Variance Detects	1.482E+9	Percent Non-Detects	72.73%
Mean Detects	30473	SD Detects	38495
Median Detects	17900	CV Detects	1.263
Skewness Detects	1.447	Kurtosis Detects	1.829
Mean of Logged Detects	7.9	SD of Logged Detects	3.96

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8312	KM Standard Error of Mean	5331
KM SD	22824	95% KM (BCA) UCL	17847
95% KM (t) UCL	17485	95% KM (Percentile Bootstrap) UCL	17401
95% KM (z) UCL	17080	95% KM Bootstrap t UCL	31833
90% KM Chebyshev UCL	24304	95% KM Chebyshev UCL	31548
97.5% KM Chebyshev UCL	41602	99% KM Chebyshev UCL	61351

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.456	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.771	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.234	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.287	k star (bias corrected MLE)	0.254
Theta hat (MLE)	106338	Theta star (bias corrected MLE)	119786
nu hat (MLE)	3.439	nu star (bias corrected)	3.053
Mean (detects)	30473		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	8311
Maximum	100000	Median	0.01
SD	23362	CV	2.811
k hat (MLE)	0.0815	k star (bias corrected MLE)	0.101
Theta hat (MLE)	102031	Theta star (bias corrected MLE)	82572
nu hat (MLE)	3.584	nu star (bias corrected)	4.429
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (4.43, α)	0.898	Adjusted Chi Square Value (4.43, β)	0.789
95% Gamma Approximate UCL (use when n>=50)	40987	95% Gamma Adjusted UCL (use when n<50)	46667

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chlorobenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8312	SD (KM)	22824
Variance (KM)	5.210E+8	SE of Mean (KM)	5331
k hat (KM)	0.133	k star (KM)	0.145
nu hat (KM)	5.835	nu star (KM)	6.373
theta hat (KM)	62675	theta star (KM)	57388
80% gamma percentile (KM)	8786	90% gamma percentile (KM)	24520
95% gamma percentile (KM)	46054	99% gamma percentile (KM)	108998

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.37, α)	1.833	Adjusted Chi Square Value (6.37, β)	1.658
95% Gamma Approximate KM-UCL (use when n>=50)	28894	95% Gamma Adjusted KM-UCL (use when n<50)	31951

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.802	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.294	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8311	Mean in Log Scale	-0.802
SD in Original Scale	23362	SD in Log Scale	5.827
95% t UCL (assumes normality of ROS data)	16881	95% Percentile Bootstrap UCL	17401
95% BCA Bootstrap UCL	21437	95% Bootstrap t UCL	38350
95% H-UCL (Log ROS)	1.748E+13		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.599	KM Geo Mean	4.95
KM SD (logged)	4.392	95% Critical H Value (KM-Log)	8.558
KM Standard Error of Mean (logged)	1.058	95% H-UCL (KM -Log)	2.794E+8
KM SD (logged)	4.392	95% Critical H Value (KM-Log)	8.558
KM Standard Error of Mean (logged)	1.058		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8463	Mean in Log Scale	3.631
SD in Original Scale	23308	SD in Log Scale	4.284
95% t UCL (Assumes normality)	17014	95% H-Stat UCL	9.019E+8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	17485

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene

General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	6
Number of Detects	11	Number of Non-Detects	11
Number of Distinct Detects	11	Number of Distinct Non-Detects	11
Minimum Detect	6.8	Minimum Non-Detect	0.28
Maximum Detect	210000	Maximum Non-Detect	670
Variance Detects	3.954E+9	Percent Non-Detects	50%
Mean Detects	26597	SD Detects	62880
Median Detects	2400	CV Detects	2.364
Skewness Detects	2.98	Kurtosis Detects	9.147
Mean of Logged Detects	6.761	SD of Logged Detects	3.659

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.497	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.391	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	13300	KM Standard Error of Mean	9935
KM SD	44430	95% KM (BCA) UCL	32263
95% KM (t) UCL	30396	95% KM (Percentile Bootstrap) UCL	31809
95% KM (z) UCL	29642	95% KM Bootstrap t UCL	185079
90% KM Chebyshev UCL	43105	95% KM Chebyshev UCL	56605
97.5% KM Chebyshev UCL	75343	99% KM Chebyshev UCL	112150

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.422	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.856	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.162	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.281	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.213	k star (bias corrected MLE)	0.215
Theta hat (MLE)	125066	Theta star (bias corrected MLE)	123551
nu hat (MLE)	4.679	nu star (bias corrected)	4.736
Mean (detects)	26597		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	13298
Maximum	210000	Median	3.405
SD	45476	CV	3.42
k hat (MLE)	0.0969	k star (bias corrected MLE)	0.114
Theta hat (MLE)	137286	Theta star (bias corrected MLE)	116693
nu hat (MLE)	4.262	nu star (bias corrected)	5.014
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (5.01, α)	1.159	Adjusted Chi Square Value (5.01, β)	1.029
95% Gamma Approximate UCL (use when n>=50)	57545	95% Gamma Adjusted UCL (use when n<50)	64822

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	13300	SD (KM)	44430
Variance (KM)	1.974E+9	SE of Mean (KM)	9935
k hat (KM)	0.0896	k star (KM)	0.108
nu hat (KM)	3.943	nu star (KM)	4.739
theta hat (KM)	148416	theta star (KM)	123497
80% gamma percentile (KM)	10224	90% gamma percentile (KM)	36424
95% gamma percentile (KM)	76784	99% gamma percentile (KM)	203518

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.74, α)	1.033	Adjusted Chi Square Value (4.74, β)	0.913
95% Gamma Approximate KM-UCL (use when n>=50)	60987	95% Gamma Adjusted KM-UCL (use when n<50)	69030

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.169	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	13298	Mean in Log Scale	2.447
SD in Original Scale	45476	SD in Log Scale	5.143
95% t UCL (assumes normality of ROS data)	29982	95% Percentile Bootstrap UCL	31340
95% BCA Bootstrap UCL	46911	95% Bootstrap t UCL	185839
95% H-UCL (Log ROS)	4.627E+11		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.008	KM Geo Mean	20.25
KM SD (logged)	4.587	95% Critical H Value (KM-Log)	8.922
KM Standard Error of Mean (logged)	1.048	95% H-UCL (KM -Log)	5.658E+9
KM SD (logged)	4.587	95% Critical H Value (KM-Log)	8.922
KM Standard Error of Mean (logged)	1.048		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	13322	Mean in Log Scale	3.99
SD in Original Scale	45469	SD in Log Scale	4.259
95% t UCL (Assumes normality)	30002	95% H-Stat UCL	1.056E+9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	69030

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tetrachloroethene

General Statistics

Total Number of Observations	22	Number of Distinct Observations	20
		Number of Missing Observations	6
Number of Detects	5	Number of Non-Detects	17
Number of Distinct Detects	5	Number of Distinct Non-Detects	16
Minimum Detect	0.56	Minimum Non-Detect	0.39
Maximum Detect	40000	Maximum Non-Detect	1800
Variance Detects	3.138E+8	Percent Non-Detects	77.27%
Mean Detects	8324	SD Detects	17715
Median Detects	320	CV Detects	2.128
Skewness Detects	2.231	Kurtosis Detects	4.982
Mean of Logged Detects	4.672	SD of Logged Detects	4.699

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.576	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.454	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1903	KM Standard Error of Mean	1983
KM SD	8318	95% KM (BCA) UCL	5533
95% KM (t) UCL	5316	95% KM (Percentile Bootstrap) UCL	5517
95% KM (z) UCL	5165	95% KM Bootstrap t UCL	122012
90% KM Chebyshev UCL	7852	95% KM Chebyshev UCL	10547
97.5% KM Chebyshev UCL	14287	99% KM Chebyshev UCL	21634

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.339	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.801	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.224	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.393	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.173	k star (bias corrected MLE)	0.202
Theta hat (MLE)	48167	Theta star (bias corrected MLE)	41116
nu hat (MLE)	1.728	nu star (bias corrected)	2.025
Mean (detects)	8324		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1892
Maximum	40000	Median	0.01
SD	8516	CV	4.501
k hat (MLE)	0.0827	k star (bias corrected MLE)	0.102
Theta hat (MLE)	22864	Theta star (bias corrected MLE)	18591
nu hat (MLE)	3.641	nu star (bias corrected)	4.478
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (4.48, α)	0.919	Adjusted Chi Square Value (4.48, β)	0.808
95% Gamma Approximate UCL (use when n>=50)	9218	95% Gamma Adjusted UCL (use when n<50)	10485

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tetrachloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1903	SD (KM)	8318
Variance (KM)	69195686	SE of Mean (KM)	1983
k hat (KM)	0.0524	k star (KM)	0.0755
nu hat (KM)	2.304	nu star (KM)	3.323
theta hat (KM)	36355	theta star (KM)	25204
80% gamma percentile (KM)	806	90% gamma percentile (KM)	4344
95% gamma percentile (KM)	11029	99% gamma percentile (KM)	34635

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.32, α)	0.474	Adjusted Chi Square Value (3.32, β)	0.406
95% Gamma Approximate KM-UCL (use when n>=50)	13339	95% Gamma Adjusted KM-UCL (use when n<50)	15566

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.218	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1892	Mean in Log Scale	-2.57
SD in Original Scale	8516	SD in Log Scale	4.758
95% t UCL (assumes normality of ROS data)	5016	95% Percentile Bootstrap UCL	5498
95% BCA Bootstrap UCL	7509	95% Bootstrap t UCL	236405
95% H-UCL (Log ROS)	92672535		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.683	KM Geo Mean	1.981
KM SD (logged)	3.124	95% Critical H Value (KM-Log)	6.205
KM Standard Error of Mean (logged)	0.805	95% H-UCL (KM -Log)	17903
KM SD (logged)	3.124	95% Critical H Value (KM-Log)	6.205
KM Standard Error of Mean (logged)	0.805		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2038	Mean in Log Scale	3.388
SD in Original Scale	8486	SD in Log Scale	3.359
95% t UCL (Assumes normality)	5152	95% H-Stat UCL	1079869

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	15566

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	22	Number of Distinct Observations	20
		Number of Missing Observations	6
Number of Detects	11	Number of Non-Detects	11
Number of Distinct Detects	11	Number of Distinct Non-Detects	10
Minimum Detect	0.51	Minimum Non-Detect	0.6
Maximum Detect	25000	Maximum Non-Detect	3050
Variance Detects	61381765	Percent Non-Detects	50%
Mean Detects	3504	SD Detects	7835
Median Detects	85.5	CV Detects	2.236
Skewness Detects	2.55	Kurtosis Detects	6.428
Mean of Logged Detects	4.385	SD of Logged Detects	3.744

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.533	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.414	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1781	KM Standard Error of Mean	1243
KM SD	5558	95% KM (BCA) UCL	3836
95% KM (t) UCL	3921	95% KM (Percentile Bootstrap) UCL	3992
95% KM (z) UCL	3826	95% KM Bootstrap t UCL	25828
90% KM Chebyshev UCL	5511	95% KM Chebyshev UCL	7201
97.5% KM Chebyshev UCL	9546	99% KM Chebyshev UCL	14153

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.545	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.865	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.282	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.196	k star (bias corrected MLE)	0.203
Theta hat (MLE)	17921	Theta star (bias corrected MLE)	17278
nu hat (MLE)	4.302	nu star (bias corrected)	4.462
Mean (detects)	3504		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1752
Maximum	25000	Median	0.26
SD	5696	CV	3.251
k hat (MLE)	0.106	k star (bias corrected MLE)	0.122
Theta hat (MLE)	16480	Theta star (bias corrected MLE)	14347
nu hat (MLE)	4.678	nu star (bias corrected)	5.374
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (5.37, α)	1.329	Adjusted Chi Square Value (5.37, β)	1.186
95% Gamma Approximate UCL (use when n>=50)	7087	95% Gamma Adjusted UCL (use when n<50)	7938

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1781	SD (KM)	5558
Variance (KM)	30896147	SE of Mean (KM)	1243
k hat (KM)	0.103	k star (KM)	0.119
nu hat (KM)	4.517	nu star (KM)	5.234
theta hat (KM)	17349	theta star (KM)	14971
80% gamma percentile (KM)	1546	90% gamma percentile (KM)	5033
95% gamma percentile (KM)	10173	99% gamma percentile (KM)	25896

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.23, α)	1.262	Adjusted Chi Square Value (5.23, β)	1.124
95% Gamma Approximate KM-UCL (use when n>=50)	7387	95% Gamma Adjusted KM-UCL (use when n<50)	8292

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.129	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1754	Mean in Log Scale	2.415
SD in Original Scale	5695	SD in Log Scale	3.445
95% t UCL (assumes normality of ROS data)	3844	95% Percentile Bootstrap UCL	3911
95% BCA Bootstrap UCL	5659	95% Bootstrap t UCL	28987
95% H-UCL (Log ROS)	698213		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.513	KM Geo Mean	12.34
KM SD (logged)	3.48	95% Critical H Value (KM-Log)	6.861
KM Standard Error of Mean (logged)	0.855	95% H-UCL (KM -Log)	963182
KM SD (logged)	3.48	95% Critical H Value (KM-Log)	6.861
KM Standard Error of Mean (logged)	0.855		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1961	Mean in Log Scale	4.066
SD in Original Scale	5644	SD in Log Scale	3.393
95% t UCL (Assumes normality)	4032	95% H-Stat UCL	2626906

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	8292

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride

General Statistics

Total Number of Observations	22	Number of Distinct Observations	21
		Number of Missing Observations	6
Number of Detects	5	Number of Non-Detects	17
Number of Distinct Detects	5	Number of Distinct Non-Detects	16
Minimum Detect	3	Minimum Non-Detect	0.29
Maximum Detect	200	Maximum Non-Detect	3050
Variance Detects	5631	Percent Non-Detects	77.27%
Mean Detects	94.1	SD Detects	75.04
Median Detects	83.5	CV Detects	0.797
Skewness Detects	0.406	Kurtosis Detects	-0.158
Mean of Logged Detects	3.936	SD of Logged Detects	1.66

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.989	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.156	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	32.53	KM Standard Error of Mean	17.08
KM SD	58.74	95% KM (BCA) UCL	63
95% KM (t) UCL	61.92	95% KM (Percentile Bootstrap) UCL	60.19
95% KM (z) UCL	60.62	95% KM Bootstrap t UCL	61.69
90% KM Chebyshev UCL	83.77	95% KM Chebyshev UCL	107
97.5% KM Chebyshev UCL	139.2	99% KM Chebyshev UCL	202.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.351	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.693	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.365	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.954	k star (bias corrected MLE)	0.515
Theta hat (MLE)	98.67	Theta star (bias corrected MLE)	182.8
nu hat (MLE)	9.536	nu star (bias corrected)	5.148
Mean (detects)	94.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	22.14
Maximum	200	Median	0.01
SD	51.77	CV	2.338
k hat (MLE)	0.143	k star (bias corrected MLE)	0.154
Theta hat (MLE)	155.1	Theta star (bias corrected MLE)	144.2
nu hat (MLE)	6.279	nu star (bias corrected)	6.756
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (6.76, α)	2.038	Adjusted Chi Square Value (6.76, β)	1.85
95% Gamma Approximate UCL (use when n>=50)	73.4	95% Gamma Adjusted UCL (use when n<50)	80.84

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	32.53	SD (KM)	58.74
Variance (KM)	3451	SE of Mean (KM)	17.08
k hat (KM)	0.307	k star (KM)	0.295
nu hat (KM)	13.49	nu star (KM)	12.99
theta hat (KM)	106.1	theta star (KM)	110.2
80% gamma percentile (KM)	49.69	90% gamma percentile (KM)	96.13
95% gamma percentile (KM)	149.6	99% gamma percentile (KM)	288.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.99, α)	5.885	Adjusted Chi Square Value (12.99, β)	5.53
95% Gamma Approximate KM-UCL (use when n>=50)	71.8	95% Gamma Adjusted KM-UCL (use when n<50)	76.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.313	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	23.02	Mean in Log Scale	1.219
SD in Original Scale	51.31	SD in Log Scale	1.805
95% t UCL (assumes normality of ROS data)	41.85	95% Percentile Bootstrap UCL	42.03
95% BCA Bootstrap UCL	49.9	95% Bootstrap t UCL	61.05
95% H-UCL (Log ROS)	78.67		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.729	KM Geo Mean	2.073
KM SD (logged)	2.558	95% Critical H Value (KM-Log)	5.174
KM Standard Error of Mean (logged)	0.792	95% H-UCL (KM -Log)	980.8
KM SD (logged)	2.558	95% Critical H Value (KM-Log)	5.174
KM Standard Error of Mean (logged)	0.792		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	213.3	Mean in Log Scale	3.07
SD in Original Scale	391	SD in Log Scale	2.983
95% t UCL (Assumes normality)	356.7	95% H-Stat UCL	88439

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	61.92

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total)

General Statistics

Total Number of Observations	22	Number of Distinct Observations	22
		Number of Missing Observations	6
Number of Detects	12	Number of Non-Detects	10
Number of Distinct Detects	12	Number of Distinct Non-Detects	10
Minimum Detect	1.9	Minimum Non-Detect	0.42
Maximum Detect	590000	Maximum Non-Detect	530
Variance Detects	2.855E+10	Percent Non-Detects	45.45%
Mean Detects	53828	SD Detects	168972
Median Detects	2160	CV Detects	3.139
Skewness Detects	3.455	Kurtosis Detects	11.96
Mean of Logged Detects	6.931	SD of Logged Detects	3.603

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.357	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.499	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	29363	KM Standard Error of Mean	27267
KM SD	122450	95% KM (BCA) UCL	83408
95% KM (t) UCL	76283	95% KM (Percentile Bootstrap) UCL	82573
95% KM (z) UCL	74213	95% KM Bootstrap t UCL	962806
90% KM Chebyshev UCL	111165	95% KM Chebyshev UCL	148218
97.5% KM Chebyshev UCL	199647	99% KM Chebyshev UCL	300669

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.834	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.883	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.273	Detected Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.188	k star (bias corrected MLE)	0.196
Theta hat (MLE)	286987	Theta star (bias corrected MLE)	274314
nu hat (MLE)	4.501	nu star (bias corrected)	4.709
Mean (detects)	53828		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	29361
Maximum	590000	Median	12.45
SD	125332	CV	4.269
k hat (MLE)	0.095	k star (bias corrected MLE)	0.112
Theta hat (MLE)	308961	Theta star (bias corrected MLE)	261275
nu hat (MLE)	4.181	nu star (bias corrected)	4.944
Adjusted Level of Significance (β)	0.0386		
Approximate Chi Square Value (4.94, α)	1.127	Adjusted Chi Square Value (4.94, β)	0.999
95% Gamma Approximate UCL (use when n>=50)	128857	95% Gamma Adjusted UCL (use when n<50)	145324

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	29363	SD (KM)	122450
Variance (KM)	1.499E+10	SE of Mean (KM)	27267
k hat (KM)	0.0575	k star (KM)	0.08
nu hat (KM)	2.53	nu star (KM)	3.518
theta hat (KM)	510647	theta star (KM)	367204
80% gamma percentile (KM)	13962	90% gamma percentile (KM)	69601
95% gamma percentile (KM)	170742	99% gamma percentile (KM)	520146

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.52, α)	0.541	Adjusted Chi Square Value (3.52, β)	0.466
95% Gamma Approximate KM-UCL (use when n>=50)	190873	95% Gamma Adjusted KM-UCL (use when n<50)	221749

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.136	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	29361	Mean in Log Scale	3.269
SD in Original Scale	125332	SD in Log Scale	4.932
95% t UCL (assumes normality of ROS data)	75341	95% Percentile Bootstrap UCL	82564
95% BCA Bootstrap UCL	109764	95% Bootstrap t UCL	942426
95% H-UCL (Log ROS)	1.505E+11		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.688	KM Geo Mean	39.97
KM SD (logged)	4.476	95% Critical H Value (KM-Log)	8.715
KM Standard Error of Mean (logged)	1.022	95% H-UCL (KM -Log)	4.469E+9
KM SD (logged)	4.476	95% Critical H Value (KM-Log)	8.715
KM Standard Error of Mean (logged)	1.022		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	29389	Mean in Log Scale	4.561
SD in Original Scale	125325	SD in Log Scale	4.189
95% t UCL (Assumes normality)	75366	95% H-Stat UCL	1.094E+9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	221749

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Number of Detects	9	Number of Non-Detects	6
Number of Distinct Detects	9	Number of Distinct Non-Detects	6
Minimum Detect	11	Minimum Non-Detect	8.2
Maximum Detect	6400	Maximum Non-Detect	200
Variance Detects	4316270	Percent Non-Detects	40%
Mean Detects	877.4	SD Detects	2078
Median Detects	220	CV Detects	2.368
Skewness Detects	2.964	Kurtosis Detects	8.837
Mean of Logged Detects	5.021	SD of Logged Detects	1.937

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.461	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.474	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	533	KM Standard Error of Mean	431.3
KM SD	1575	95% KM (BCA) UCL	1373
95% KM (t) UCL	1293	95% KM (Percentile Bootstrap) UCL	1363
95% KM (z) UCL	1242	95% KM Bootstrap t UCL	6501
90% KM Chebyshev UCL	1827	95% KM Chebyshev UCL	2413
97.5% KM Chebyshev UCL	3226	99% KM Chebyshev UCL	4824

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.835	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.793	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.323	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.299	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.378	k star (bias corrected MLE)	0.326
Theta hat (MLE)	2321	Theta star (bias corrected MLE)	2691
nu hat (MLE)	6.805	nu star (bias corrected)	5.87
Mean (detects)	877.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	526.5
Maximum	6400	Median	23
SD	1632	CV	3.1
k hat (MLE)	0.151	k star (bias corrected MLE)	0.165
Theta hat (MLE)	3493	Theta star (bias corrected MLE)	3190
nu hat (MLE)	4.522	nu star (bias corrected)	4.951
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (4.95, α)	1.129	Adjusted Chi Square Value (4.95, β)	0.924
95% Gamma Approximate UCL (use when n>=50)	2308	95% Gamma Adjusted UCL (use when n<50)	2820

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	533	SD (KM)	1575
Variance (KM)	2480020	SE of Mean (KM)	431.3
k hat (KM)	0.115	k star (KM)	0.136
nu hat (KM)	3.437	nu star (KM)	4.083
theta hat (KM)	4653	theta star (KM)	3917
80% gamma percentile (KM)	532.5	90% gamma percentile (KM)	1555
95% gamma percentile (KM)	2986	99% gamma percentile (KM)	7224

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.08, α)	0.755	Adjusted Chi Square Value (4.08, β)	0.6
95% Gamma Approximate KM-UCL (use when n>=50)	2884	95% Gamma Adjusted KM-UCL (use when n<50)	3624

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	529.6	Mean in Log Scale	3.713
SD in Original Scale	1631	SD in Log Scale	2.288
95% t UCL (assumes normality of ROS data)	1271	95% Percentile Bootstrap UCL	1361
95% BCA Bootstrap UCL	1756	95% Bootstrap t UCL	6768
95% H-UCL (Log ROS)	12942		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.04	KM Geo Mean	56.81
KM SD (logged)	1.896	95% Critical H Value (KM-Log)	4.362
KM Standard Error of Mean (logged)	0.532	95% H-UCL (KM -Log)	3127
KM SD (logged)	1.896	95% Critical H Value (KM-Log)	4.362
KM Standard Error of Mean (logged)	0.532		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	543.6	Mean in Log Scale	4.294
SD in Original Scale	1627	SD in Log Scale	1.894
95% t UCL (Assumes normality)	1283	95% H-Stat UCL	3990

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	3226	99% KM (Chebyshev) UCL	4824

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Number of Detects	7	Number of Non-Detects	8
Number of Distinct Detects	7	Number of Distinct Non-Detects	8
Minimum Detect	31	Minimum Non-Detect	1.1
Maximum Detect	4500	Maximum Non-Detect	170
Variance Detects	2585818	Percent Non-Detects	53.33%
Mean Detects	886	SD Detects	1608
Median Detects	270	CV Detects	1.815
Skewness Detects	2.548	Kurtosis Detects	6.603
Mean of Logged Detects	5.599	SD of Logged Detects	1.718

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.576	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.434	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	416.5	KM Standard Error of Mean	309
KM SD	1108	95% KM (BCA) UCL	988
95% KM (t) UCL	960.7	95% KM (Percentile Bootstrap) UCL	980.8
95% KM (z) UCL	924.7	95% KM Bootstrap t UCL	2902
90% KM Chebyshev UCL	1343	95% KM Chebyshev UCL	1763
97.5% KM Chebyshev UCL	2346	99% KM Chebyshev UCL	3491

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.522	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.286	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.327	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.53	k star (bias corrected MLE)	0.398
Theta hat (MLE)	1671	Theta star (bias corrected MLE)	2225
nu hat (MLE)	7.422	nu star (bias corrected)	5.574
Mean (detects)	886		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	413.5
Maximum	4500	Median	0.01
SD	1148	CV	2.776
k hat (MLE)	0.133	k star (bias corrected MLE)	0.151
Theta hat (MLE)	3104	Theta star (bias corrected MLE)	2738
nu hat (MLE)	3.997	nu star (bias corrected)	4.531
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (4.53, α)	0.942	Adjusted Chi Square Value (4.53, β)	0.761
95% Gamma Approximate UCL (use when n>=50)	1989	95% Gamma Adjusted UCL (use when n<50)	2462

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	416.5	SD (KM)	1108
Variance (KM)	1227291	SE of Mean (KM)	309
k hat (KM)	0.141	k star (KM)	0.158
nu hat (KM)	4.24	nu star (KM)	4.725
theta hat (KM)	2947	theta star (KM)	2644
80% gamma percentile (KM)	471.2	90% gamma percentile (KM)	1243
95% gamma percentile (KM)	2270	99% gamma percentile (KM)	5222

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.73, α)	1.027	Adjusted Chi Square Value (4.73, β)	0.835
95% Gamma Approximate KM-UCL (use when n>=50)	1915	95% Gamma Adjusted KM-UCL (use when n<50)	2356

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.196	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	415.6	Mean in Log Scale	3.29
SD in Original Scale	1147	SD in Log Scale	2.527
95% t UCL (assumes normality of ROS data)	937.2	95% Percentile Bootstrap UCL	984.8
95% BCA Bootstrap UCL	1314	95% Bootstrap t UCL	3027
95% H-UCL (Log ROS)	28866		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.922	KM Geo Mean	18.59
KM SD (logged)	2.864	95% Critical H Value (KM-Log)	6.293
KM Standard Error of Mean (logged)	0.846	95% H-UCL (KM -Log)	138927
KM SD (logged)	2.864	95% Critical H Value (KM-Log)	6.293
KM Standard Error of Mean (logged)	0.846		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	425.4	Mean in Log Scale	3.831
SD in Original Scale	1143	SD in Log Scale	2.333
95% t UCL (Assumes normality)	945.4	95% H-Stat UCL	18176

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	2356

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Number of Detects	11	Number of Non-Detects	4
Number of Distinct Detects	11	Number of Distinct Non-Detects	4
Minimum Detect	9	Minimum Non-Detect	8.2
Maximum Detect	6200	Maximum Non-Detect	170
Variance Detects	3204821	Percent Non-Detects	26.67%
Mean Detects	926.1	SD Detects	1790
Median Detects	470	CV Detects	1.933
Skewness Detects	3.055	Kurtosis Detects	9.692
Mean of Logged Detects	5.564	SD of Logged Detects	1.803

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.529	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	684.2	KM Standard Error of Mean	410.5
KM SD	1516	95% KM (BCA) UCL	1462
95% KM (t) UCL	1407	95% KM (Percentile Bootstrap) UCL	1424
95% KM (z) UCL	1359	95% KM Bootstrap t UCL	3539
90% KM Chebyshev UCL	1916	95% KM Chebyshev UCL	2474
97.5% KM Chebyshev UCL	3248	99% KM Chebyshev UCL	4769

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.463	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.781	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.269	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.501	k star (bias corrected MLE)	0.425
Theta hat (MLE)	1847	Theta star (bias corrected MLE)	2178
nu hat (MLE)	11.03	nu star (bias corrected)	9.354
Mean (detects)	926.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	679.1
Maximum	6200	Median	96
SD	1571	CV	2.314
k hat (MLE)	0.201	k star (bias corrected MLE)	0.205
Theta hat (MLE)	3387	Theta star (bias corrected MLE)	3315
nu hat (MLE)	6.016	nu star (bias corrected)	6.146
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (6.15, α)	1.715	Adjusted Chi Square Value (6.15, β)	1.444
95% Gamma Approximate UCL (use when n>=50)	2434	95% Gamma Adjusted UCL (use when n<50)	2891

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	684.2	SD (KM)	1516
Variance (KM)	2297744	SE of Mean (KM)	410.5
k hat (KM)	0.204	k star (KM)	0.207
nu hat (KM)	6.112	nu star (KM)	6.223
theta hat (KM)	3358	theta star (KM)	3298
80% gamma percentile (KM)	918.4	90% gamma percentile (KM)	2069
95% gamma percentile (KM)	3492	99% gamma percentile (KM)	7385

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.22, α)	1.755	Adjusted Chi Square Value (6.22, β)	1.479
95% Gamma Approximate KM-UCL (use when n>=50)	2426	95% Gamma Adjusted KM-UCL (use when n<50)	2878

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	682.2	Mean in Log Scale	4.641
SD in Original Scale	1570	SD in Log Scale	2.241
95% t UCL (assumes normality of ROS data)	1396	95% Percentile Bootstrap UCL	1449
95% BCA Bootstrap UCL	1913	95% Bootstrap t UCL	3703
95% H-UCL (Log ROS)	26052		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.727	KM Geo Mean	112.9
KM SD (logged)	2.063	95% Critical H Value (KM-Log)	4.687
KM Standard Error of Mean (logged)	0.566	95% H-UCL (KM -Log)	12573
KM SD (logged)	2.063	95% Critical H Value (KM-Log)	4.687
KM Standard Error of Mean (logged)	0.566		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	686.8	Mean in Log Scale	4.8
SD in Original Scale	1568	SD in Log Scale	2.102
95% t UCL (Assumes normality)	1400	95% H-Stat UCL	16064

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	2878

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Number of Detects	6	Number of Non-Detects	9
Number of Distinct Detects	6	Number of Distinct Non-Detects	9
Minimum Detect	13	Minimum Non-Detect	0.6
Maximum Detect	2300	Maximum Non-Detect	170
Variance Detects	758131	Percent Non-Detects	60%
Mean Detects	545.7	SD Detects	870.7
Median Detects	247.5	CV Detects	1.596
Skewness Detects	2.31	Kurtosis Detects	5.468
Mean of Logged Detects	5.262	SD of Logged Detects	1.732

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.649	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.404	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	220.3	KM Standard Error of Mean	160.9
KM SD	568.7	95% KM (BCA) UCL	527.2
95% KM (t) UCL	503.6	95% KM (Percentile Bootstrap) UCL	516.1
95% KM (z) UCL	484.9	95% KM Bootstrap t UCL	1242
90% KM Chebyshev UCL	702.9	95% KM Chebyshev UCL	921.5
97.5% KM Chebyshev UCL	1225	99% KM Chebyshev UCL	1821

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.315	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.254	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.347	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.595	k star (bias corrected MLE)	0.408
Theta hat (MLE)	917.6	Theta star (bias corrected MLE)	1336
nu hat (MLE)	7.136	nu star (bias corrected)	4.901
Mean (detects)	545.7		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	218.3
Maximum	2300	Median	0.01
SD	589.3	CV	2.7
k hat (MLE)	0.13	k star (bias corrected MLE)	0.148
Theta hat (MLE)	1682	Theta star (bias corrected MLE)	1472
nu hat (MLE)	3.894	nu star (bias corrected)	4.449
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (4.45, α)	0.906	Adjusted Chi Square Value (4.45, β)	0.73
95% Gamma Approximate UCL (use when n>=50)	1071	95% Gamma Adjusted UCL (use when n<50)	1329

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	220.3	SD (KM)	568.7
Variance (KM)	323388	SE of Mean (KM)	160.9
k hat (KM)	0.15	k star (KM)	0.164
nu hat (KM)	4.501	nu star (KM)	4.934
theta hat (KM)	1468	theta star (KM)	1339
80% gamma percentile (KM)	257.3	90% gamma percentile (KM)	660.1
95% gamma percentile (KM)	1189	99% gamma percentile (KM)	2698

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.93, α)	1.122	Adjusted Chi Square Value (4.93, β)	0.917
95% Gamma Approximate KM-UCL (use when n>=50)	968.8	95% Gamma Adjusted KM-UCL (use when n<50)	1185

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	219.3	Mean in Log Scale	2.379
SD in Original Scale	588.9	SD in Log Scale	2.665
95% t UCL (assumes normality of ROS data)	487.1	95% Percentile Bootstrap UCL	507.3
95% BCA Bootstrap UCL	671.3	95% Bootstrap t UCL	1435
95% H-UCL (Log ROS)	24878		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.999	KM Geo Mean	7.382
KM SD (logged)	2.962	95% Critical H Value (KM-Log)	6.492
KM Standard Error of Mean (logged)	0.877	95% H-UCL (KM -Log)	101202
KM SD (logged)	2.962	95% Critical H Value (KM-Log)	6.492
KM Standard Error of Mean (logged)	0.877		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	228.9	Mean in Log Scale	3.109
SD in Original Scale	585.6	SD in Log Scale	2.517
95% t UCL (Assumes normality)	495.2	95% H-Stat UCL	22831

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	1185

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	13
Number of Detects	12	Number of Non-Detects	3
Number of Distinct Detects	12	Number of Distinct Non-Detects	3
Minimum Detect	14	Minimum Non-Detect	8.2
Maximum Detect	9800	Maximum Non-Detect	82
Variance Detects	9002402	Percent Non-Detects	20%
Mean Detects	1605	SD Detects	3000
Median Detects	280	CV Detects	1.869
Skewness Detects	2.364	Kurtosis Detects	5.251
Mean of Logged Detects	5.724	SD of Logged Detects	2.078

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.597	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.348	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1288	KM Standard Error of Mean	713.8
KM SD	2647	95% KM (BCA) UCL	2557
95% KM (t) UCL	2545	95% KM (Percentile Bootstrap) UCL	2558
95% KM (z) UCL	2462	95% KM Bootstrap t UCL	8586
90% KM Chebyshev UCL	3429	95% KM Chebyshev UCL	4399
97.5% KM Chebyshev UCL	5745	99% KM Chebyshev UCL	8390

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.547	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.805	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.262	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.397	k star (bias corrected MLE)	0.354
Theta hat (MLE)	4039	Theta star (bias corrected MLE)	4539
nu hat (MLE)	9.538	nu star (bias corrected)	8.487
Mean (detects)	1605		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1284
Maximum	9800	Median	240
SD	2741	CV	2.135
k hat (MLE)	0.209	k star (bias corrected MLE)	0.212
Theta hat (MLE)	6149	Theta star (bias corrected MLE)	6071
nu hat (MLE)	6.265	nu star (bias corrected)	6.346
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (6.35, α)	1.819	Adjusted Chi Square Value (6.35, β)	1.537
95% Gamma Approximate UCL (use when n>=50)	4480	95% Gamma Adjusted UCL (use when n<50)	5301

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1288	SD (KM)	2647
Variance (KM)	7005553	SE of Mean (KM)	713.8
k hat (KM)	0.237	k star (KM)	0.234
nu hat (KM)	7.099	nu star (KM)	7.013
theta hat (KM)	5441	theta star (KM)	5508
80% gamma percentile (KM)	1823	90% gamma percentile (KM)	3880
95% gamma percentile (KM)	6356	99% gamma percentile (KM)	13010

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.01, α)	2.177	Adjusted Chi Square Value (7.01, β)	1.861
95% Gamma Approximate KM-UCL (use when n>=50)	4147	95% Gamma Adjusted KM-UCL (use when n<50)	4851

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1286	Mean in Log Scale	4.959
SD in Original Scale	2740	SD in Log Scale	2.474
95% t UCL (assumes normality of ROS data)	2532	95% Percentile Bootstrap UCL	2509
95% BCA Bootstrap UCL	2928	95% Bootstrap t UCL	8164
95% H-UCL (Log ROS)	115799		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.1	KM Geo Mean	163.9
KM SD (logged)	2.19	95% Critical H Value (KM-Log)	4.938
KM Standard Error of Mean (logged)	0.594	95% H-UCL (KM -Log)	32493
KM SD (logged)	2.19	95% Critical H Value (KM-Log)	4.938
KM Standard Error of Mean (logged)	0.594		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1289	Mean in Log Scale	5.127
SD in Original Scale	2739	SD in Log Scale	2.263
95% t UCL (Assumes normality)	2534	95% H-Stat UCL	47156

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	4851

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	15	Number of Distinct Observations	13
		Number of Missing Observations	13
Minimum	2600	Mean	7376
Maximum	20700	Median	6080
SD	5469	Std. Error of Mean	1412
Coefficient of Variation	0.741	Skewness	1.815

Normal GOF Test

Shapiro Wilk Test Statistic	0.741	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.298	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9863	95% Adjusted-CLT UCL (Chen-1995)	10406
		95% Modified-t UCL (Johnson-1978)	9973

Gamma GOF Test

A-D Test Statistic	0.797	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.223	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.224	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.716	k star (bias corrected MLE)	2.217
Theta hat (MLE)	2716	Theta star (bias corrected MLE)	3327
nu hat (MLE)	81.47	nu star (bias corrected)	66.51
MLE Mean (bias corrected)	7376	MLE Sd (bias corrected)	4954
		Approximate Chi Square Value (0.05)	48.74
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	46.87

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	10065	95% Adjusted Gamma UCL (use when n<50)	10466

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.179	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.863	Mean of logged Data	8.711
Maximum of Logged Data	9.938	SD of logged Data	0.615

Assuming Lognormal Distribution

95% H-UCL	10515	90% Chebyshev (MVUE) UCL	10810
95% Chebyshev (MVUE) UCL	12435	97.5% Chebyshev (MVUE) UCL	14690
99% Chebyshev (MVUE) UCL	19119		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	9699	95% Jackknife UCL	9863
95% Standard Bootstrap UCL	9586	95% Bootstrap-t UCL	12888
95% Hall's Bootstrap UCL	22473	95% Percentile Bootstrap UCL	9723
95% BCA Bootstrap UCL	10319		
90% Chebyshev(Mean, Sd) UCL	11612	95% Chebyshev(Mean, Sd) UCL	13531
97.5% Chebyshev(Mean, Sd) UCL	16195	99% Chebyshev(Mean, Sd) UCL	21426

Suggested UCL to Use

95% Adjusted Gamma UCL	10466

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	13
Minimum	0.415	Mean	17.11
Maximum	191	Median	2.3
SD	48.47	Std. Error of Mean	12.51
Coefficient of Variation	2.832	Skewness	3.777

Normal GOF Test

Shapiro Wilk Test Statistic	0.372	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.407	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	39.15	95% Adjusted-CLT UCL (Chen-1995)	50.74
		95% Modified-t UCL (Johnson-1978)	41.19

Gamma GOF Test

A-D Test Statistic	1.527	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.818	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.273	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.238	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.381	k star (bias corrected MLE)	0.349
Theta hat (MLE)	44.96	Theta star (bias corrected MLE)	49.04
nu hat (MLE)	11.42	nu star (bias corrected)	10.47
MLE Mean (bias corrected)	17.11	MLE Sd (bias corrected)	28.97
		Approximate Chi Square Value (0.05)	4.237
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	3.761

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	42.28	95% Adjusted Gamma UCL (use when n<50)	47.64

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.143	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.879	Mean of logged Data	1.097
Maximum of Logged Data	5.252	SD of logged Data	1.707

Assuming Lognormal Distribution

95% H-UCL	79.83	90% Chebyshev (MVUE) UCL	26.71
95% Chebyshev (MVUE) UCL	34.01	97.5% Chebyshev (MVUE) UCL	44.15
99% Chebyshev (MVUE) UCL	64.05		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	37.7	95% Jackknife UCL	39.15
95% Standard Bootstrap UCL	36.83	95% Bootstrap-t UCL	223.7
95% Hall's Bootstrap UCL	133.5	95% Percentile Bootstrap UCL	41.41
95% BCA Bootstrap UCL	53.99		
90% Chebyshev(Mean, Sd) UCL	54.66	95% Chebyshev(Mean, Sd) UCL	71.66
97.5% Chebyshev(Mean, Sd) UCL	95.27	99% Chebyshev(Mean, Sd) UCL	141.6

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	141.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Minimum	5.7	Mean	15.96
Maximum	30	Median	13.6
SD	7.514	Std. Error of Mean	1.94
Coefficient of Variation	0.471	Skewness	0.509

Normal GOF Test

Shapiro Wilk Test Statistic	0.943	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	19.38	95% Adjusted-CLT UCL (Chen-1995)	19.42
		95% Modified-t UCL (Johnson-1978)	19.42

Gamma GOF Test

A-D Test Statistic	0.239	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.739	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.136	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.222	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.634	k star (bias corrected MLE)	3.752
Theta hat (MLE)	3.444	Theta star (bias corrected MLE)	4.254
nu hat (MLE)	139	nu star (bias corrected)	112.5
MLE Mean (bias corrected)	15.96	MLE Sd (bias corrected)	8.24
		Approximate Chi Square Value (0.05)	89.06
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	86.49

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	20.17	95% Adjusted Gamma UCL (use when n<50)	20.77

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.115	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.74	Mean of logged Data	2.658
Maximum of Logged Data	3.401	SD of logged Data	0.505

Assuming Lognormal Distribution

95% H-UCL	21.44	90% Chebyshev (MVUE) UCL	22.53
95% Chebyshev (MVUE) UCL	25.46	97.5% Chebyshev (MVUE) UCL	29.52
99% Chebyshev (MVUE) UCL	37.51		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	19.15	95% Jackknife UCL	19.38
95% Standard Bootstrap UCL	19.06	95% Bootstrap-t UCL	20.02
95% Hall's Bootstrap UCL	19.32	95% Percentile Bootstrap UCL	18.99
95% BCA Bootstrap UCL	19.53		
90% Chebyshev(Mean, Sd) UCL	21.78	95% Chebyshev(Mean, Sd) UCL	24.42
97.5% Chebyshev(Mean, Sd) UCL	28.08	99% Chebyshev(Mean, Sd) UCL	35.26

Suggested UCL to Use

95% Student's-t UCL	19.38

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Minimum	23.7	Mean	1597
Maximum	7810	Median	622
SD	2319	Std. Error of Mean	598.7
Coefficient of Variation	1.452	Skewness	2.096

Normal GOF Test

Shapiro Wilk Test Statistic	0.678	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.267	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2652	95% Adjusted-CLT UCL (Chen-1995)	2928
		95% Modified-t UCL (Johnson-1978)	2706

Gamma GOF Test

A-D Test Statistic	0.293	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.785	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.113	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.232	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.61	k star (bias corrected MLE)	0.532
Theta hat (MLE)	2618	Theta star (bias corrected MLE)	2999
nu hat (MLE)	18.3	nu star (bias corrected)	15.97
MLE Mean (bias corrected)	1597	MLE Sd (bias corrected)	2189
		Approximate Chi Square Value (0.05)	7.944
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	7.256

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	3211	95% Adjusted Gamma UCL (use when n<50)	3516

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.1	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.165	Mean of logged Data	6.366
Maximum of Logged Data	8.963	SD of logged Data	1.648

Assuming Lognormal Distribution

95% H-UCL	12540	90% Chebyshev (MVUE) UCL	4679
95% Chebyshev (MVUE) UCL	5939	97.5% Chebyshev (MVUE) UCL	7688
99% Chebyshev (MVUE) UCL	11123		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2582	95% Jackknife UCL	2652
95% Standard Bootstrap UCL	2550	95% Bootstrap-t UCL	4416
95% Hall's Bootstrap UCL	7832	95% Percentile Bootstrap UCL	2637
95% BCA Bootstrap UCL	3016		
90% Chebyshev(Mean, Sd) UCL	3393	95% Chebyshev(Mean, Sd) UCL	4207
97.5% Chebyshev(Mean, Sd) UCL	5336	99% Chebyshev(Mean, Sd) UCL	7554

Suggested UCL to Use

95% Adjusted Gamma UCL	3516

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Number of Detects	14	Number of Non-Detects	1
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	0.35	Minimum Non-Detect	0.6
Maximum Detect	29	Maximum Non-Detect	0.6
Variance Detects	56.96	Percent Non-Detects	6.667%
Mean Detects	5.88	SD Detects	7.547
Median Detects	4.35	CV Detects	1.284
Skewness Detects	2.467	Kurtosis Detects	7.126
Mean of Logged Detects	1.047	SD of Logged Detects	1.346

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.709	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.518	KM Standard Error of Mean	1.917
KM SD	7.156	95% KM (BCA) UCL	8.655
95% KM (t) UCL	8.895	95% KM (Percentile Bootstrap) UCL	8.831
95% KM (z) UCL	8.672	95% KM Bootstrap t UCL	11.99
90% KM Chebyshev UCL	11.27	95% KM Chebyshev UCL	13.88
97.5% KM Chebyshev UCL	17.49	99% KM Chebyshev UCL	24.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.317	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.768	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.127	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.237	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.817	k star (bias corrected MLE)	0.69
Theta hat (MLE)	7.198	Theta star (bias corrected MLE)	8.528
nu hat (MLE)	22.87	nu star (bias corrected)	19.31
Mean (detects)	5.88		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.489
Maximum	29	Median	4.2
SD	7.429	CV	1.354
k hat (MLE)	0.599	k star (bias corrected MLE)	0.523
Theta hat (MLE)	9.168	Theta star (bias corrected MLE)	10.49
nu hat (MLE)	17.96	nu star (bias corrected)	15.7
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (15.70, α)	7.752	Adjusted Chi Square Value (15.70, β)	7.073
95% Gamma Approximate UCL (use when n>=50)	11.12	95% Gamma Adjusted UCL (use when n<50)	12.18

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.518	SD (KM)	7.156
Variance (KM)	51.2	SE of Mean (KM)	1.917
k hat (KM)	0.595	k star (KM)	0.52
nu hat (KM)	17.84	nu star (KM)	15.61
theta hat (KM)	9.279	theta star (KM)	10.61
80% gamma percentile (KM)	9.077	90% gamma percentile (KM)	14.81
95% gamma percentile (KM)	20.9	99% gamma percentile (KM)	35.83

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.61, α)	7.685	Adjusted Chi Square Value (15.61, β)	7.01
95% Gamma Approximate KM-UCL (use when n>=50)	11.21	95% Gamma Adjusted KM-UCL (use when n<50)	12.29

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.951	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.519	Mean in Log Scale	0.927
SD in Original Scale	7.406	SD in Log Scale	1.378
95% t UCL (assumes normality of ROS data)	8.887	95% Percentile Bootstrap UCL	8.845
95% BCA Bootstrap UCL	10.06	95% Bootstrap t UCL	12.07
95% H-UCL (Log ROS)	22.72		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.924	KM Geo Mean	2.518
KM SD (logged)	1.336	95% Critical H Value (KM-Log)	3.314
KM Standard Error of Mean (logged)	0.358	95% H-UCL (KM -Log)	20.08
KM SD (logged)	1.336	95% Critical H Value (KM-Log)	3.314
KM Standard Error of Mean (logged)	0.358		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.508	Mean in Log Scale	0.897
SD in Original Scale	7.414	SD in Log Scale	1.421
95% t UCL (Assumes normality)	8.88	95% H-Stat UCL	25.11

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	12.29

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	15	Number of Distinct Observations	14
		Number of Missing Observations	13
Number of Detects	11	Number of Non-Detects	4
Number of Distinct Detects	10	Number of Distinct Non-Detects	4
Minimum Detect	1	Minimum Non-Detect	0.26
Maximum Detect	26	Maximum Non-Detect	3
Variance Detects	62.65	Percent Non-Detects	26.67%
Mean Detects	7.918	SD Detects	7.915
Median Detects	5.3	CV Detects	1
Skewness Detects	1.293	Kurtosis Detects	1.418
Mean of Logged Detects	1.525	SD of Logged Detects	1.17

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.845	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.955	KM Standard Error of Mean	1.961
KM SD	7.24	95% KM (BCA) UCL	9.124
95% KM (t) UCL	9.409	95% KM (Percentile Bootstrap) UCL	9.341
95% KM (z) UCL	9.181	95% KM Bootstrap t UCL	11.05
90% KM Chebyshev UCL	11.84	95% KM Chebyshev UCL	14.5
97.5% KM Chebyshev UCL	18.2	99% KM Chebyshev UCL	25.47

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.383	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.182	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.262	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.055	k star (bias corrected MLE)	0.828
Theta hat (MLE)	7.507	Theta star (bias corrected MLE)	9.567
nu hat (MLE)	23.2	nu star (bias corrected)	18.21
Mean (detects)	7.918		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.809
Maximum	26	Median	1.7
SD	7.606	CV	1.309
k hat (MLE)	0.358	k star (bias corrected MLE)	0.331
Theta hat (MLE)	16.21	Theta star (bias corrected MLE)	17.54
nu hat (MLE)	10.75	nu star (bias corrected)	9.935
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (9.93, α)	3.901	Adjusted Chi Square Value (9.93, β)	3.448
95% Gamma Approximate UCL (use when n>=50)	14.79	95% Gamma Adjusted UCL (use when n<50)	16.74

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.955	SD (KM)	7.24
Variance (KM)	52.42	SE of Mean (KM)	1.961
k hat (KM)	0.676	k star (KM)	0.586
nu hat (KM)	20.29	nu star (KM)	17.57
theta hat (KM)	8.804	theta star (KM)	10.17
80% gamma percentile (KM)	9.815	90% gamma percentile (KM)	15.57
95% gamma percentile (KM)	21.62	99% gamma percentile (KM)	36.27

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.57, α)	9.078	Adjusted Chi Square Value (17.57, β)	8.336
95% Gamma Approximate KM-UCL (use when n>=50)	11.52	95% Gamma Adjusted KM-UCL (use when n<50)	12.55

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.954	Mean in Log Scale	0.923
SD in Original Scale	7.493	SD in Log Scale	1.458
95% t UCL (assumes normality of ROS data)	9.361	95% Percentile Bootstrap UCL	9.191
95% BCA Bootstrap UCL	10.08	95% Bootstrap t UCL	11.07
95% H-UCL (Log ROS)	28.93		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.886	KM Geo Mean	2.426
KM SD (logged)	1.473	95% Critical H Value (KM-Log)	3.562
KM Standard Error of Mean (logged)	0.408	95% H-UCL (KM -Log)	29.19
KM SD (logged)	1.473	95% Critical H Value (KM-Log)	3.562
KM Standard Error of Mean (logged)	0.408		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.977	Mean in Log Scale	0.872
SD in Original Scale	7.479	SD in Log Scale	1.591
95% t UCL (Assumes normality)	9.378	95% H-Stat UCL	42.27

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	9.409

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	15	Number of Distinct Observations	13
		Number of Missing Observations	13
Minimum	2.9	Mean	11.89
Maximum	37	Median	11
SD	8.852	Std. Error of Mean	2.286
Coefficient of Variation	0.745	Skewness	1.717

Normal GOF Test

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15.91	95% Adjusted-CLT UCL (Chen-1995)	16.73
		95% Modified-t UCL (Johnson-1978)	16.08

Gamma GOF Test

A-D Test Statistic	0.291	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.144	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.224	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.225	k star (bias corrected MLE)	1.824
Theta hat (MLE)	5.343	Theta star (bias corrected MLE)	6.516
nu hat (MLE)	66.74	nu star (bias corrected)	54.72
MLE Mean (bias corrected)	11.89	MLE Sd (bias corrected)	8.801
		Approximate Chi Square Value (0.05)	38.72
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	37.07

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	16.8	95% Adjusted Gamma UCL (use when n<50)	17.55

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.159	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.065	Mean of logged Data	2.234
Maximum of Logged Data	3.611	SD of logged Data	0.735

Assuming Lognormal Distribution

95% H-UCL	19.43	90% Chebyshev (MVUE) UCL	19.19
95% Chebyshev (MVUE) UCL	22.46	97.5% Chebyshev (MVUE) UCL	27
99% Chebyshev (MVUE) UCL	35.92		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	15.65	95% Jackknife UCL	15.91
95% Standard Bootstrap UCL	15.55	95% Bootstrap-t UCL	17.85
95% Hall's Bootstrap UCL	24.4	95% Percentile Bootstrap UCL	15.81
95% BCA Bootstrap UCL	16.84		
90% Chebyshev(Mean, Sd) UCL	18.74	95% Chebyshev(Mean, Sd) UCL	21.85
97.5% Chebyshev(Mean, Sd) UCL	26.16	99% Chebyshev(Mean, Sd) UCL	34.63

Suggested UCL to Use

95% Adjusted Gamma UCL	17.55

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Minimum	29	Mean	1423
Maximum	7340	Median	900
SD	1901	Std. Error of Mean	490.9
Coefficient of Variation	1.336	Skewness	2.359

Normal GOF Test

Shapiro Wilk Test Statistic	0.717	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.232	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2287	95% Adjusted-CLT UCL (Chen-1995)	2549
		95% Modified-t UCL (Johnson-1978)	2337

Gamma GOF Test

A-D Test Statistic	0.415	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.784	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.232	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.628	k star (bias corrected MLE)	0.547
Theta hat (MLE)	2264	Theta star (bias corrected MLE)	2600
nu hat (MLE)	18.85	nu star (bias corrected)	16.42
MLE Mean (bias corrected)	1423	MLE Sd (bias corrected)	1923
		Approximate Chi Square Value (0.05)	8.256
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	7.553

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2829	95% Adjusted Gamma UCL (use when n<50)	3092

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.367	Mean of logged Data	6.284
Maximum of Logged Data	8.901	SD of logged Data	1.66

Assuming Lognormal Distribution

95% H-UCL	12049	90% Chebyshev (MVUE) UCL	4401
95% Chebyshev (MVUE) UCL	5589	97.5% Chebyshev (MVUE) UCL	7239
99% Chebyshev (MVUE) UCL	10480		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2230	95% Jackknife UCL	2287
95% Standard Bootstrap UCL	2223	95% Bootstrap-t UCL	2972
95% Hall's Bootstrap UCL	5534	95% Percentile Bootstrap UCL	2270
95% BCA Bootstrap UCL	2494		
90% Chebyshev(Mean, Sd) UCL	2895	95% Chebyshev(Mean, Sd) UCL	3562
97.5% Chebyshev(Mean, Sd) UCL	4488	99% Chebyshev(Mean, Sd) UCL	6307

Suggested UCL to Use

95% Adjusted Gamma UCL	3092

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	14	Number of Distinct Observations	14
		Number of Missing Observations	14
Number of Detects	11	Number of Non-Detects	3
Number of Distinct Detects	11	Number of Distinct Non-Detects	3
Minimum Detect	0.12	Minimum Non-Detect	0.15
Maximum Detect	11	Maximum Non-Detect	0.64
Variance Detects	15.11	Percent Non-Detects	21.43%
Mean Detects	3.101	SD Detects	3.888
Median Detects	0.33	CV Detects	1.254
Skewness Detects	1.152	Kurtosis Detects	0.122
Mean of Logged Detects	0.0164	SD of Logged Detects	1.732

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.784	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.478	KM Standard Error of Mean	0.98
KM SD	3.496	95% KM (BCA) UCL	4.157
95% KM (t) UCL	4.214	95% KM (Percentile Bootstrap) UCL	4.169
95% KM (z) UCL	4.09	95% KM Bootstrap t UCL	5.229
90% KM Chebyshev UCL	5.418	95% KM Chebyshev UCL	6.75
97.5% KM Chebyshev UCL	8.598	99% KM Chebyshev UCL	12.23

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.858	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.777	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.319	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.268	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.56	k star (bias corrected MLE)	0.468
Theta hat (MLE)	5.54	Theta star (bias corrected MLE)	6.63
nu hat (MLE)	12.31	nu star (bias corrected)	10.29
Mean (detects)	3.101		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.439
Maximum	11	Median	0.305
SD	3.655	CV	1.499
k hat (MLE)	0.359	k star (bias corrected MLE)	0.33
Theta hat (MLE)	6.793	Theta star (bias corrected MLE)	7.396
nu hat (MLE)	10.05	nu star (bias corrected)	9.231
Adjusted Level of Significance (β)	0.0312		
Approximate Chi Square Value (9.23, α)	3.467	Adjusted Chi Square Value (9.23, β)	3.014
95% Gamma Approximate UCL (use when n>=50)	6.492	95% Gamma Adjusted UCL (use when n<50)	7.469

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.478	SD (KM)	3.496
Variance (KM)	12.22	SE of Mean (KM)	0.98
k hat (KM)	0.503	k star (KM)	0.443
nu hat (KM)	14.07	nu star (KM)	12.39
theta hat (KM)	4.931	theta star (KM)	5.6
80% gamma percentile (KM)	4.04	90% gamma percentile (KM)	6.871
95% gamma percentile (KM)	9.94	99% gamma percentile (KM)	17.58

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.39, α)	5.486	Adjusted Chi Square Value (12.39, β)	4.889
95% Gamma Approximate KM-UCL (use when n>=50)	5.598	95% Gamma Adjusted KM-UCL (use when n<50)	6.281

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.848	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.287	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.251	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.479	Mean in Log Scale	-0.382
SD in Original Scale	3.627	SD in Log Scale	1.754
95% t UCL (assumes normality of ROS data)	4.196	95% Percentile Bootstrap UCL	4.097
95% BCA Bootstrap UCL	4.594	95% Bootstrap t UCL	5.202
95% H-UCL (Log ROS)	24.29		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.358	KM Geo Mean	0.699
KM SD (logged)	1.643	95% Critical H Value (KM-Log)	3.966
KM Standard Error of Mean (logged)	0.463	95% H-UCL (KM -Log)	16.43
KM SD (logged)	1.643	95% Critical H Value (KM-Log)	3.966
KM Standard Error of Mean (logged)	0.463		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.487	Mean in Log Scale	-0.337
SD in Original Scale	3.622	SD in Log Scale	1.705
95% t UCL (Assumes normality)	4.201	95% H-Stat UCL	21.11

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

975% KM (Chebyshev) UCL	8.598

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Number of Detects	14	Number of Non-Detects	1
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	5700	Minimum Non-Detect	69100
Maximum Detect	210000	Maximum Non-Detect	69100
Variance Detects	3.767E+9	Percent Non-Detects	6.667%
Mean Detects	53879	SD Detects	61378
Median Detects	24150	CV Detects	1.139
Skewness Detects	1.658	Kurtosis Detects	2.25
Mean of Logged Detects	10.31	SD of Logged Detects	1.14

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.778	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	51768	KM Standard Error of Mean	15549
KM SD	57849	95% KM (BCA) UCL	79367
95% KM (t) UCL	79155	95% KM (Percentile Bootstrap) UCL	75953
95% KM (z) UCL	77344	95% KM Bootstrap t UCL	99288
90% KM Chebyshev UCL	98416	95% KM Chebyshev UCL	119545
97.5% KM Chebyshev UCL	148873	99% KM Chebyshev UCL	206480

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.442	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.76	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.195	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.235	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.99	k star (bias corrected MLE)	0.826
Theta hat (MLE)	54407	Theta star (bias corrected MLE)	65252
nu hat (MLE)	27.73	nu star (bias corrected)	23.12
Mean (detects)	53879		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	5700	Mean	51483
Maximum	210000	Median	23000
SD	59868	CV	1.163
k hat (MLE)	1.007	k star (bias corrected MLE)	0.85
Theta hat (MLE)	51102	Theta star (bias corrected MLE)	60539
nu hat (MLE)	30.22	nu star (bias corrected)	25.51
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (25.51, α)	15	Adjusted Chi Square Value (25.51, β)	14.02
95% Gamma Approximate UCL (use when n>=50)	87538	95% Gamma Adjusted UCL (use when n<50)	93694

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	51768	SD (KM)	57849
Variance (KM)	3.346E+9	SE of Mean (KM)	15549
k hat (KM)	0.801	k star (KM)	0.685
nu hat (KM)	24.02	nu star (KM)	20.55
theta hat (KM)	64644	theta star (KM)	75563
80% gamma percentile (KM)	85151	90% gamma percentile (KM)	130604
95% gamma percentile (KM)	177578	99% gamma percentile (KM)	289911

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.55, α)	11.26	Adjusted Chi Square Value (20.55, β)	10.42
95% Gamma Approximate KM-UCL (use when n>=50)	94494	95% Gamma Adjusted KM-UCL (use when n<50)	102106

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.132	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	51537	Mean in Log Scale	10.28
SD in Original Scale	59836	SD in Log Scale	1.105
95% t UCL (assumes normality of ROS data)	78749	95% Percentile Bootstrap UCL	77407
95% BCA Bootstrap UCL	85233	95% Bootstrap t UCL	96109
95% H-UCL (Log ROS)	126794		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	10.27	KM Geo Mean	28953
KM SD (logged)	1.086	95% Critical H Value (KM-Log)	2.883
KM Standard Error of Mean (logged)	0.296	95% H-UCL (KM -Log)	120563
KM SD (logged)	1.086	95% Critical H Value (KM-Log)	2.883
KM Standard Error of Mean (logged)	0.296		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	52590	Mean in Log Scale	10.32
SD in Original Scale	59355	SD in Log Scale	1.099
95% t UCL (Assumes normality)	79583	95% H-Stat UCL	130157

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	102106

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Number of Detects	14	Number of Non-Detects	1
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	48	Minimum Non-Detect	9.4
Maximum Detect	16000	Maximum Non-Detect	9.4
Variance Detects	18751031	Percent Non-Detects	6.667%
Mean Detects	2487	SD Detects	4330
Median Detects	597	CV Detects	1.741
Skewness Detects	2.703	Kurtosis Detects	7.914
Mean of Logged Detects	6.537	SD of Logged Detects	1.785

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.614	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.296	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2321	KM Standard Error of Mean	1093
KM SD	4078	95% KM (BCA) UCL	4428
95% KM (t) UCL	4246	95% KM (Percentile Bootstrap) UCL	4249
95% KM (z) UCL	4119	95% KM Bootstrap t UCL	7296
90% KM Chebyshev UCL	5600	95% KM Chebyshev UCL	7085
97.5% KM Chebyshev UCL	9146	99% KM Chebyshev UCL	13194

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.46	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.794	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.192	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.242	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.496	k star (bias corrected MLE)	0.438
Theta hat (MLE)	5010	Theta star (bias corrected MLE)	5682
nu hat (MLE)	13.9	nu star (bias corrected)	12.25
Mean (detects)	2487		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2321
Maximum	16000	Median	590
SD	4222	CV	1.819
k hat (MLE)	0.345	k star (bias corrected MLE)	0.32
Theta hat (MLE)	6731	Theta star (bias corrected MLE)	7246
nu hat (MLE)	10.34	nu star (bias corrected)	9.608
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (9.61, α)	3.698	Adjusted Chi Square Value (9.61, β)	3.26
95% Gamma Approximate UCL (use when n>=50)	6029	95% Gamma Adjusted UCL (use when n<50)	6841

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2321	SD (KM)	4078
Variance (KM)	16632712	SE of Mean (KM)	1093
k hat (KM)	0.324	k star (KM)	0.304
nu hat (KM)	9.72	nu star (KM)	9.109
theta hat (KM)	7165	theta star (KM)	7645
80% gamma percentile (KM)	3571	90% gamma percentile (KM)	6837
95% gamma percentile (KM)	10578	99% gamma percentile (KM)	20287

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.11, α)	3.393	Adjusted Chi Square Value (9.11, β)	2.977
95% Gamma Approximate KM-UCL (use when n>=50)	6232	95% Gamma Adjusted KM-UCL (use when n<50)	7104

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.108	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2321	Mean in Log Scale	6.243
SD in Original Scale	4222	SD in Log Scale	2.063
95% t UCL (assumes normality of ROS data)	4241	95% Percentile Bootstrap UCL	4195
95% BCA Bootstrap UCL	5215	95% Bootstrap t UCL	6602
95% H-UCL (Log ROS)	57294		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	6.251	KM Geo Mean	518.5
KM SD (logged)	1.977	95% Critical H Value (KM-Log)	4.519
KM Standard Error of Mean (logged)	0.53	95% H-UCL (KM -Log)	39890
KM SD (logged)	1.977	95% Critical H Value (KM-Log)	4.519
KM Standard Error of Mean (logged)	0.53		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2321	Mean in Log Scale	6.205
SD in Original Scale	4222	SD in Log Scale	2.149
95% t UCL (Assumes normality)	4241	95% H-Stat UCL	81025

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	7104

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Minimum	37	Mean	453.1
Maximum	1400	Median	333
SD	377.8	Std. Error of Mean	97.54
Coefficient of Variation	0.834	Skewness	1.489

Normal GOF Test

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.254	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	624.9	95% Adjusted-CLT UCL (Chen-1995)	653.6
		95% Modified-t UCL (Johnson-1978)	631.1

Gamma GOF Test

A-D Test Statistic	0.401	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.754	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.161	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.226	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.482	k star (bias corrected MLE)	1.23
Theta hat (MLE)	305.8	Theta star (bias corrected MLE)	368.4
nu hat (MLE)	44.45	nu star (bias corrected)	36.89
MLE Mean (bias corrected)	453.1	MLE Sd (bias corrected)	408.6
		Approximate Chi Square Value (0.05)	23.99
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	22.71

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	696.8	95% Adjusted Gamma UCL (use when n<50)	735.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.611	Mean of logged Data	5.742
Maximum of Logged Data	7.244	SD of logged Data	1.002

Assuming Lognormal Distribution

95% H-UCL	1074	90% Chebyshev (MVUE) UCL	908.3
95% Chebyshev (MVUE) UCL	1097	97.5% Chebyshev (MVUE) UCL	1359
99% Chebyshev (MVUE) UCL	1874		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	613.5	95% Jackknife UCL	624.9
95% Standard Bootstrap UCL	607.5	95% Bootstrap-t UCL	740.4
95% Hall's Bootstrap UCL	1613	95% Percentile Bootstrap UCL	617.5
95% BCA Bootstrap UCL	644.7		
90% Chebyshev(Mean, Sd) UCL	745.7	95% Chebyshev(Mean, Sd) UCL	878.2
97.5% Chebyshev(Mean, Sd) UCL	1062	99% Chebyshev(Mean, Sd) UCL	1424

Suggested UCL to Use

95% Adjusted Gamma UCL	735.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Number of Detects	14	Number of Non-Detects	1
Number of Distinct Detects	14	Number of Distinct Non-Detects	1
Minimum Detect	0.035	Minimum Non-Detect	0.12
Maximum Detect	3.9	Maximum Non-Detect	0.12
Variance Detects	1.237	Percent Non-Detects	6.667%
Mean Detects	0.877	SD Detects	1.112
Median Detects	0.51	CV Detects	1.268
Skewness Detects	1.964	Kurtosis Detects	3.721
Mean of Logged Detects	-0.918	SD of Logged Detects	1.419

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.746	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.238	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.822	KM Standard Error of Mean	0.283
KM SD	1.055	95% KM (BCA) UCL	1.283
95% KM (t) UCL	1.32	95% KM (Percentile Bootstrap) UCL	1.3
95% KM (z) UCL	1.287	95% KM Bootstrap t UCL	1.833
90% KM Chebyshev UCL	1.67	95% KM Chebyshev UCL	2.055
97.5% KM Chebyshev UCL	2.588	99% KM Chebyshev UCL	3.635

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.263	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.77	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.135	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.237	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.759	k star (bias corrected MLE)	0.644
Theta hat (MLE)	1.154	Theta star (bias corrected MLE)	1.361
nu hat (MLE)	21.27	nu star (bias corrected)	18.04
Mean (detects)	0.877		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.819
Maximum	3.9	Median	0.32
SD	1.095	CV	1.337
k hat (MLE)	0.635	k star (bias corrected MLE)	0.553
Theta hat (MLE)	1.289	Theta star (bias corrected MLE)	1.482
nu hat (MLE)	19.06	nu star (bias corrected)	16.58
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (16.58, α)	8.373	Adjusted Chi Square Value (16.58, β)	7.664
95% Gamma Approximate UCL (use when n>=50)	1.622	95% Gamma Adjusted UCL (use when n<50)	1.772

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.822	SD (KM)	1.055
Variance (KM)	1.113	SE of Mean (KM)	0.283
k hat (KM)	0.607	k star (KM)	0.53
nu hat (KM)	18.21	nu star (KM)	15.9
theta hat (KM)	1.354	theta star (KM)	1.551
80% gamma percentile (KM)	1.353	90% gamma percentile (KM)	2.197
95% gamma percentile (KM)	3.093	99% gamma percentile (KM)	5.284

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.90, α)	7.894	Adjusted Chi Square Value (15.90, β)	7.208
95% Gamma Approximate KM-UCL (use when n>=50)	1.656	95% Gamma Adjusted KM-UCL (use when n<50)	1.814

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.822	Mean in Log Scale	-1.046
SD in Original Scale	1.092	SD in Log Scale	1.454
95% t UCL (assumes normality of ROS data)	1.319	95% Percentile Bootstrap UCL	1.333
95% BCA Bootstrap UCL	1.407	95% Bootstrap t UCL	1.919
95% H-UCL (Log ROS)	3.984		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.051	KM Geo Mean	0.35
KM SD (logged)	1.413	95% Critical H Value (KM-Log)	3.453
KM Standard Error of Mean (logged)	0.38	95% H-UCL (KM -Log)	3.5
KM SD (logged)	1.413	95% Critical H Value (KM-Log)	3.453
KM Standard Error of Mean (logged)	0.38		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.822	Mean in Log Scale	-1.045
SD in Original Scale	1.092	SD in Log Scale	1.452
95% t UCL (Assumes normality)	1.319	95% H-Stat UCL	3.963

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	1.814

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Minimum	10	Mean	157.7
Maximum	860	Median	42.6
SD	253.4	Std. Error of Mean	65.42
Coefficient of Variation	1.607	Skewness	2.215

Normal GOF Test

Shapiro Wilk Test Statistic	0.631	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	272.9	95% Adjusted-CLT UCL (Chen-1995)	305.3
		95% Modified-t UCL (Johnson-1978)	279.2

Gamma GOF Test

A-D Test Statistic	0.951	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.785	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.247	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.232	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.618	k star (bias corrected MLE)	0.539
Theta hat (MLE)	255.3	Theta star (bias corrected MLE)	292.8
nu hat (MLE)	18.53	nu star (bias corrected)	16.16
MLE Mean (bias corrected)	157.7	MLE Sd (bias corrected)	214.9
		Approximate Chi Square Value (0.05)	8.075
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	7.38

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	315.6	95% Adjusted Gamma UCL (use when n<50)	345.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.178	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.303	Mean of logged Data	4.065
Maximum of Logged Data	6.757	SD of logged Data	1.423

Assuming Lognormal Distribution

95% H-UCL	600	90% Chebyshev (MVUE) UCL	321.3
95% Chebyshev (MVUE) UCL	402.2	97.5% Chebyshev (MVUE) UCL	514.5
99% Chebyshev (MVUE) UCL	735		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	265.3	95% Jackknife UCL	272.9
95% Standard Bootstrap UCL	259.4	95% Bootstrap-t UCL	526.1
95% Hall's Bootstrap UCL	767.3	95% Percentile Bootstrap UCL	267.2
95% BCA Bootstrap UCL	307.2		
90% Chebyshev(Mean, Sd) UCL	354	95% Chebyshev(Mean, Sd) UCL	442.8
97.5% Chebyshev(Mean, Sd) UCL	566.2	99% Chebyshev(Mean, Sd) UCL	808.6

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	442.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	13
		Number of Missing Observations	13
Number of Detects	10	Number of Non-Detects	5
Number of Distinct Detects	9	Number of Distinct Non-Detects	4
Minimum Detect	0.093	Minimum Non-Detect	0.12
Maximum Detect	2.4	Maximum Non-Detect	3
Variance Detects	0.487	Percent Non-Detects	33.33%
Mean Detects	0.46	SD Detects	0.698
Median Detects	0.2	CV Detects	1.518
Skewness Detects	2.905	Kurtosis Detects	8.753
Mean of Logged Detects	-1.339	SD of Logged Detects	0.975

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.548	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.367	KM Standard Error of Mean	0.164
KM SD	0.581	95% KM (BCA) UCL	0.686
95% KM (t) UCL	0.656	95% KM (Percentile Bootstrap) UCL	0.649
95% KM (z) UCL	0.636	95% KM Bootstrap t UCL	1.407
90% KM Chebyshev UCL	0.859	95% KM Chebyshev UCL	1.082
97.5% KM Chebyshev UCL	1.391	99% KM Chebyshev UCL	1.998

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.955	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.748	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.252	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.274	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.024	k star (bias corrected MLE)	0.783
Theta hat (MLE)	0.449	Theta star (bias corrected MLE)	0.587
nu hat (MLE)	20.47	nu star (bias corrected)	15.67
Mean (detects)	0.46		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.325
Maximum	2.4	Median	0.147
SD	0.594	CV	1.828
k hat (MLE)	0.632	k star (bias corrected MLE)	0.55
Theta hat (MLE)	0.514	Theta star (bias corrected MLE)	0.591
nu hat (MLE)	18.96	nu star (bias corrected)	16.5
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (16.50, α)	8.318	Adjusted Chi Square Value (16.50, β)	7.611
95% Gamma Approximate UCL (use when n>=50)	0.645	95% Gamma Adjusted UCL (use when n<50)	0.705

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.367	SD (KM)	0.581
Variance (KM)	0.337	SE of Mean (KM)	0.164
k hat (KM)	0.399	k star (KM)	0.363
nu hat (KM)	11.96	nu star (KM)	10.9
theta hat (KM)	0.919	theta star (KM)	1.009
80% gamma percentile (KM)	0.584	90% gamma percentile (KM)	1.053
95% gamma percentile (KM)	1.574	99% gamma percentile (KM)	2.9

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.90, α)	4.515	Adjusted Chi Square Value (10.90, β)	4.02
95% Gamma Approximate KM-UCL (use when n>=50)	0.886	95% Gamma Adjusted KM-UCL (use when n<50)	0.995

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.209	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.35	Mean in Log Scale	-1.602
SD in Original Scale	0.583	SD in Log Scale	0.912
95% t UCL (assumes normality of ROS data)	0.615	95% Percentile Bootstrap UCL	0.639
95% BCA Bootstrap UCL	0.792	95% Bootstrap t UCL	1.363
95% H-UCL (Log ROS)	0.577		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.566	KM Geo Mean	0.209
KM SD (logged)	0.89	95% Critical H Value (KM-Log)	2.573
KM Standard Error of Mean (logged)	0.257	95% H-UCL (KM -Log)	0.572
KM SD (logged)	0.89	95% Critical H Value (KM-Log)	2.573
KM Standard Error of Mean (logged)	0.257		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.444	Mean in Log Scale	-1.461
SD in Original Scale	0.65	SD in Log Scale	1.084
95% t UCL (Assumes normality)	0.739	95% H-Stat UCL	0.961

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	0.995

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Minimum	11	Mean	26.37
Maximum	79	Median	22.1
SD	17.28	Std. Error of Mean	4.461
Coefficient of Variation	0.655	Skewness	2.163

Normal GOF Test

Shapiro Wilk Test Statistic	0.775	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	34.23	95% Adjusted-CLT UCL (Chen-1995)	36.37
		95% Modified-t UCL (Johnson-1978)	34.65

Gamma GOF Test

A-D Test Statistic	0.415	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.126	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.223	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.428	k star (bias corrected MLE)	2.787
Theta hat (MLE)	7.694	Theta star (bias corrected MLE)	9.464
nu hat (MLE)	102.8	nu star (bias corrected)	83.6
MLE Mean (bias corrected)	26.37	MLE Sd (bias corrected)	15.8
		Approximate Chi Square Value (0.05)	63.52
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	61.37

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	34.71	95% Adjusted Gamma UCL (use when n<50)	35.92

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.107	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.398	Mean of logged Data	3.119
Maximum of Logged Data	4.369	SD of logged Data	0.549

Assuming Lognormal Distribution

95% H-UCL	35.92	90% Chebyshev (MVUE) UCL	37.47
95% Chebyshev (MVUE) UCL	42.66	97.5% Chebyshev (MVUE) UCL	49.86
99% Chebyshev (MVUE) UCL	64		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	33.71	95% Jackknife UCL	34.23
95% Standard Bootstrap UCL	33.5	95% Bootstrap-t UCL	39.73
95% Hall's Bootstrap UCL	65.92	95% Percentile Bootstrap UCL	33.86
95% BCA Bootstrap UCL	36.77		
90% Chebyshev(Mean, Sd) UCL	39.76	95% Chebyshev(Mean, Sd) UCL	45.82
97.5% Chebyshev(Mean, Sd) UCL	54.23	99% Chebyshev(Mean, Sd) UCL	70.76

Suggested UCL to Use

95% Student's-t UCL	34.23

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	15	Number of Distinct Observations	15
		Number of Missing Observations	13
Minimum	26.9	Mean	2061
Maximum	19000	Median	740
SD	4755	Std. Error of Mean	1228
Coefficient of Variation	2.307	Skewness	3.685

Normal GOF Test

Shapiro Wilk Test Statistic	0.43	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.406	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4223	95% Adjusted-CLT UCL (Chen-1995)	5329
		95% Modified-t UCL (Johnson-1978)	4418

Gamma GOF Test

A-D Test Statistic	0.756	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.802	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.209	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.235	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.457	k star (bias corrected MLE)	0.41
Theta hat (MLE)	4509	Theta star (bias corrected MLE)	5025
nu hat (MLE)	13.71	nu star (bias corrected)	12.3
MLE Mean (bias corrected)	2061	MLE Sd (bias corrected)	3218
		Approximate Chi Square Value (0.05)	5.427
Adjusted Level of Significance	0.0324	Adjusted Chi Square Value	4.875

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	4672	95% Adjusted Gamma UCL (use when n<50)	5200

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.881	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.185	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.22	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.292	Mean of logged Data	6.221
Maximum of Logged Data	9.852	SD of logged Data	1.793

Assuming Lognormal Distribution

95% H-UCL	18440	90% Chebyshev (MVUE) UCL	5218
95% Chebyshev (MVUE) UCL	6673	97.5% Chebyshev (MVUE) UCL	8691
99% Chebyshev (MVUE) UCL	12656		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4080	95% Jackknife UCL	4223
95% Standard Bootstrap UCL	4040	95% Bootstrap-t UCL	11612
95% Hall's Bootstrap UCL	11735	95% Percentile Bootstrap UCL	4520
95% BCA Bootstrap UCL	5636		
90% Chebyshev(Mean, Sd) UCL	5744	95% Chebyshev(Mean, Sd) UCL	7413
97.5% Chebyshev(Mean, Sd) UCL	9728	99% Chebyshev(Mean, Sd) UCL	14277

Suggested UCL to Use

95% Adjusted Gamma UCL	5200

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	16	Number of Distinct Observations	15
		Number of Missing Observations	12
Number of Detects	6	Number of Non-Detects	10
Number of Distinct Detects	6	Number of Distinct Non-Detects	9
Minimum Detect	53	Minimum Non-Detect	19
Maximum Detect	29000	Maximum Non-Detect	120
Variance Detects	1.320E+8	Percent Non-Detects	62.5%
Mean Detects	6881	SD Detects	11489
Median Detects	1050	CV Detects	1.67
Skewness Detects	1.942	Kurtosis Detects	3.641
Mean of Logged Detects	6.959	SD of Logged Detects	2.471

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.7	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.341	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2593	KM Standard Error of Mean	1980
KM SD	7231	95% KM (BCA) UCL	6143
95% KM (t) UCL	6064	95% KM (Percentile Bootstrap) UCL	6108
95% KM (z) UCL	5850	95% KM Bootstrap t UCL	34003
90% KM Chebyshev UCL	8533	95% KM Chebyshev UCL	11224
97.5% KM Chebyshev UCL	14959	99% KM Chebyshev UCL	22295

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.332	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.758	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.22	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.354	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.357	k star (bias corrected MLE)	0.29
Theta hat (MLE)	19274	Theta star (bias corrected MLE)	23758
nu hat (MLE)	4.284	nu star (bias corrected)	3.475
Mean (detects)	6881		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2580
Maximum	29000	Median	0.01
SD	7472	CV	2.896
k hat (MLE)	0.1	k star (bias corrected MLE)	0.123
Theta hat (MLE)	25811	Theta star (bias corrected MLE)	20996
nu hat (MLE)	3.199	nu star (bias corrected)	3.932
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (3.93, α)	0.695	Adjusted Chi Square Value (3.93, β)	0.56
95% Gamma Approximate UCL (use when n>=50)	14595	95% Gamma Adjusted UCL (use when n<50)	18113

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2593	SD (KM)	7231
Variance (KM)	52283380	SE of Mean (KM)	1980
k hat (KM)	0.129	k star (KM)	0.146
nu hat (KM)	4.114	nu star (KM)	4.676
theta hat (KM)	20167	theta star (KM)	17743
80% gamma percentile (KM)	2761	90% gamma percentile (KM)	7658
95% gamma percentile (KM)	14341	99% gamma percentile (KM)	33838

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.68, α)	1.005	Adjusted Chi Square Value (4.68, β)	0.829
95% Gamma Approximate KM-UCL (use when n>=50)	12057	95% Gamma Adjusted KM-UCL (use when n<50)	14616

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2580	Mean in Log Scale	1.991
SD in Original Scale	7472	SD in Log Scale	4.269
95% t UCL (assumes normality of ROS data)	5855	95% Percentile Bootstrap UCL	5738
95% BCA Bootstrap UCL	8001	95% Bootstrap t UCL	45250
95% H-UCL (Log ROS)	1.313E+9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.464	KM Geo Mean	86.84
KM SD (logged)	2.378	95% Critical H Value (KM-Log)	5.197
KM Standard Error of Mean (logged)	0.652	95% H-UCL (KM -Log)	35757
KM SD (logged)	2.378	95% Critical H Value (KM-Log)	5.197
KM Standard Error of Mean (logged)	0.652		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2594	Mean in Log Scale	4.456
SD in Original Scale	7467	SD in Log Scale	2.496
95% t UCL (Assumes normality)	5867	95% H-Stat UCL	64133

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	14616

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	16	Number of Distinct Observations	15
		Number of Missing Observations	12
Number of Detects	10	Number of Non-Detects	6
Number of Distinct Detects	10	Number of Distinct Non-Detects	5
Minimum Detect	51	Minimum Non-Detect	23
Maximum Detect	10000	Maximum Non-Detect	41
Variance Detects	8817713	Percent Non-Detects	37.5%
Mean Detects	2164	SD Detects	2969
Median Detects	1410	CV Detects	1.373
Skewness Detects	2.381	Kurtosis Detects	6.431
Mean of Logged Detects	6.677	SD of Logged Detects	1.75

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.696	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.315	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1361	KM Standard Error of Mean	647.3
KM SD	2456	95% KM (BCA) UCL	2622
95% KM (t) UCL	2496	95% KM (Percentile Bootstrap) UCL	2509
95% KM (z) UCL	2426	95% KM Bootstrap t UCL	3698
90% KM Chebyshev UCL	3303	95% KM Chebyshev UCL	4182
97.5% KM Chebyshev UCL	5403	99% KM Chebyshev UCL	7801

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.34	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.768	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.163	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.279	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.614	k star (bias corrected MLE)	0.497
Theta hat (MLE)	3523	Theta star (bias corrected MLE)	4357
nu hat (MLE)	12.28	nu star (bias corrected)	9.931
Mean (detects)	2164		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1352
Maximum	10000	Median	107
SD	2542	CV	1.88
k hat (MLE)	0.16	k star (bias corrected MLE)	0.172
Theta hat (MLE)	8459	Theta star (bias corrected MLE)	7882
nu hat (MLE)	5.115	nu star (bias corrected)	5.49
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (5.49, α)	1.385	Adjusted Chi Square Value (5.49, β)	1.166
95% Gamma Approximate UCL (use when n>=50)	5360	95% Gamma Adjusted UCL (use when n<50)	6367

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1361	SD (KM)	2456
Variance (KM)	6033809	SE of Mean (KM)	647.3
k hat (KM)	0.307	k star (KM)	0.291
nu hat (KM)	9.821	nu star (KM)	9.313
theta hat (KM)	4434	theta star (KM)	4676
80% gamma percentile (KM)	2071	90% gamma percentile (KM)	4028
95% gamma percentile (KM)	6286	99% gamma percentile (KM)	12176

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.31, α)	3.517	Adjusted Chi Square Value (9.31, β)	3.122
95% Gamma Approximate KM-UCL (use when n>=50)	3603	95% Gamma Adjusted KM-UCL (use when n<50)	4059

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1357	Mean in Log Scale	5.075
SD in Original Scale	2539	SD in Log Scale	2.543
95% t UCL (assumes normality of ROS data)	2470	95% Percentile Bootstrap UCL	2530
95% BCA Bootstrap UCL	2873	95% Bootstrap t UCL	3736
95% H-UCL (Log ROS)	151839		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.349	KM Geo Mean	210.4
KM SD (logged)	2.159	95% Critical H Value (KM-Log)	4.774
KM Standard Error of Mean (logged)	0.569	95% H-UCL (KM -Log)	30990
KM SD (logged)	2.159	95% Critical H Value (KM-Log)	4.774
KM Standard Error of Mean (logged)	0.569		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1359	Mean in Log Scale	5.243
SD in Original Scale	2538	SD in Log Scale	2.347
95% t UCL (Assumes normality)	2471	95% H-Stat UCL	66838

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	4059

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin

General Statistics

Total Number of Observations	14	Number of Distinct Observations	13
		Number of Missing Observations	14
Number of Detects	1	Number of Non-Detects	13
Number of Distinct Detects	1	Number of Distinct Non-Detects	12

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Dieldrin was not processed!

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	19
Minimum	4.269	Mean	183.7
Maximum	826.2	Median	41.99
SD	283.7	Std. Error of Mean	94.57
Coefficient of Variation	1.544	Skewness	1.866

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.702	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.316	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	359.6	95% Adjusted-CLT UCL (Chen-1995)	402.1
		95% Modified-t UCL (Johnson-1978)	369.4

Gamma GOF Test

A-D Test Statistic	0.393	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.77	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.192	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.505	k star (bias corrected MLE)	0.41
Theta hat (MLE)	364.1	Theta star (bias corrected MLE)	447.6
nu hat (MLE)	9.081	nu star (bias corrected)	7.388
MLE Mean (bias corrected)	183.7	MLE Sd (bias corrected)	286.7
		Approximate Chi Square Value (0.05)	2.386
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	1.831

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	568.8	95% Adjusted Gamma UCL (use when n<50)	741.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.124	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.451	Mean of logged Data	3.956
Maximum of Logged Data	6.717	SD of logged Data	1.814

Assuming Lognormal Distribution

95% H-UCL	7724	90% Chebyshev (MVUE) UCL	542.9
95% Chebyshev (MVUE) UCL	702.1	97.5% Chebyshev (MVUE) UCL	923.2
99% Chebyshev (MVUE) UCL	1357		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	339.3	95% Jackknife UCL	359.6
95% Standard Bootstrap UCL	330.7	95% Bootstrap-t UCL	878.1
95% Hall's Bootstrap UCL	1071	95% Percentile Bootstrap UCL	347.1
95% BCA Bootstrap UCL	397.7		
90% Chebyshev(Mean, Sd) UCL	467.4	95% Chebyshev(Mean, Sd) UCL	595.9
97.5% Chebyshev(Mean, Sd) UCL	774.3	99% Chebyshev(Mean, Sd) UCL	1125

Suggested UCL to Use

95% Adjusted Gamma UCL	741.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0.5)

General Statistics

Total Number of Observations	9	Number of Distinct Observations	9
		Number of Missing Observations	19
Minimum	4.383	Mean	184.4
Maximum	826.6	Median	47.38
SD	283.5	Std. Error of Mean	94.49
Coefficient of Variation	1.537	Skewness	1.868

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.317	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	360.1	95% Adjusted-CLT UCL (Chen-1995)	402.7
		95% Modified-t UCL (Johnson-1978)	369.9

Gamma GOF Test

A-D Test Statistic	0.379	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.77	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.51	k star (bias corrected MLE)	0.414
Theta hat (MLE)	361.8	Theta star (bias corrected MLE)	445.6
nu hat (MLE)	9.175	nu star (bias corrected)	7.45
MLE Mean (bias corrected)	184.4	MLE Sd (bias corrected)	286.6
		Approximate Chi Square Value (0.05)	2.421
Adjusted Level of Significance	0.0231	Adjusted Chi Square Value	1.861

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	567.5	95% Adjusted Gamma UCL (use when n<50)	738.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.964	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.829	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.126	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.274	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.478	Mean of logged Data	3.975
Maximum of Logged Data	6.717	SD of logged Data	1.806

Assuming Lognormal Distribution

95% H-UCL	7563	90% Chebyshev (MVUE) UCL	546.5
95% Chebyshev (MVUE) UCL	706.6	97.5% Chebyshev (MVUE) UCL	928.9
99% Chebyshev (MVUE) UCL	1365		

Table B.14.2

Summary of ProUCL Output for EU16 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/7/2019 12:00:31 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0.5) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	339.8	95% Jackknife UCL	360.1
95% Standard Bootstrap UCL	329.4	95% Bootstrap-t UCL	851
95% Hall's Bootstrap UCL	1023	95% Percentile Bootstrap UCL	345.3
95% BCA Bootstrap UCL	399.6		
90% Chebyshev(Mean, Sd) UCL	467.9	95% Chebyshev(Mean, Sd) UCL	596.3
97.5% Chebyshev(Mean, Sd) UCL	774.5	99% Chebyshev(Mean, Sd) UCL	1125

Suggested UCL to Use

95% Adjusted Gamma UCL 738.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.1

Summary of ProUCL Input Data for EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene
on-site (EU17)	0-2 ft BGS	SS-1	11/9/2017	280	1	270	1	370	1	30	0	54	1
on-site (EU17)	0.2-2.2 ft BGS	SS-2	11/9/2017	140	1	120	1	180	1	37	0	0.9	0
on-site (EU17)	0.3-2.3 ft BGS	SS-3	11/9/2017	600	1	465	1	770	1	132	0	54	1
on-site (EU17)	0-2 ft BGS	SS-4	12/20/2018	170	1	210	1	300	1	24	0	39	1
on-site (EU17)	0.33-2.33 ft BGS	SS-5	12/20/2018	970	1	875	1	1340	1	80.5	1	124	1
on-site (EU17)	0.33-2.33 ft BGS	SS-6	12/20/2018	230	1	310	1	440	1	71	0	60	1
on-site (EU17)	0-2 ft BGS	SS-7	12/20/2018	950	1	1000	1	1600	1	70	1	130	1
on-site (EU17)	0-2 ft BGS	SS-8	12/20/2018	540	1	600	1	960	1	67	1	140	1
on-site (EU17)	0-2 ft BGS	SS-9	12/20/2018	99	1	96	1	170	1	23	0	27	1
on-site (EU17)	0-2 ft BGS	SS-10	12/20/2018	24	1	24	1	37	1	23	0	8.3	0
on-site (EU17)	0-2 ft BGS	SS-11	12/20/2018	93	1	110	1	200	1	21	0	7.8	0
on-site (EU17)	0-2 ft BGS	SS-95	12/20/2018										
on-site (EU17)	0-2 ft BGS	SS-96	12/20/2018										
on-site (EU17)	0.33-2.33 ft BGS	SS-97	12/20/2018										
on-site (EU17)	0-2 ft BGS	SS-127	12/20/2018										
on-site (EU17)	0-2 ft BGS	SS-128	12/20/2018										
on-site (EU17)	0-2 ft BGS	SS-129	12/20/2018										
on-site (EU17)	0-0.5 ft BGS	SS-174-AS	12/20/2018										
on-site (EU17)	0-0.5 ft BGS	SS-175-AS	11/27/2018										
on-site (EU17)	0.33-0.83 ft BGS	SS-176-AS	11/27/2018										
on-site (EU17)	0-0.5 ft BGS	SS-177-AS	12/20/2018										
on-site (EU17)	0-0.5 ft BGS	SS-178-AS	12/20/2018										
on-site (EU17)	0-2 ft BGS	TP-9	11/9/2017										
on-site (EU17)	-	TT-20	10/8/2008										

Table B.15.1

Summary of ProUCL Input Data for EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				10	11	12	13	14	15	16	17	18	19	20	21
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)
on-site (EU17)	0-2 ft BGS	SS-1	11/9/2017	4700	1	0.63	1	7.3	1	87	1	0.37	1	1.3	1
on-site (EU17)	0.2-2.2 ft BGS	SS-2	11/9/2017	6300	1	2	1	25	1	380	1	4	1	3.9	1
on-site (EU17)	0.3-2.3 ft BGS	SS-3	11/9/2017	5100	1	4.25	1	14	1	610	1	2.895	1	3.65	1
on-site (EU17)	0-2 ft BGS	SS-4	12/20/2018	6500	1	0.2	1	6.2	1	130	1	0.54	1	0.31	1
on-site (EU17)	0.33-2.33 ft BGS	SS-5	12/20/2018	6250	1	7.25	1	16.5	1	505	1	10.2	1	0.72	1
on-site (EU17)	0.33-2.33 ft BGS	SS-6	12/20/2018	14000	1	260	1	29	1	1300	1	20	1	1.8	0
on-site (EU17)	0-2 ft BGS	SS-7	12/20/2018	4600	1	80	1	8.7	1	470	1	6.6	1	2.8	0
on-site (EU17)	0-2 ft BGS	SS-8	12/20/2018	11000	1	3.2	1	16	1	330	1	3	1	3.3	0
on-site (EU17)	0-2 ft BGS	SS-9	12/20/2018	10000	1	15	1	16	1	400	1	0.81	1	1.4	0
on-site (EU17)	0-2 ft BGS	SS-10	12/20/2018	12000	1	8.3	1	13	1	1800	1	0.24	1	1.4	0
on-site (EU17)	0-2 ft BGS	SS-11	12/20/2018	5500	1	0.85	1	8.2	1	86	1	0.48	1	1.4	0
on-site (EU17)	0-2 ft BGS	SS-95	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-96	12/20/2018												
on-site (EU17)	0.33-2.33 ft BGS	SS-97	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-127	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-128	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-129	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-174-AS	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-175-AS	11/27/2018												
on-site (EU17)	0.33-0.83 ft BGS	SS-176-AS	11/27/2018												
on-site (EU17)	0-0.5 ft BGS	SS-177-AS	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-178-AS	12/20/2018												
on-site (EU17)	0-2 ft BGS	TP-9	11/9/2017												
on-site (EU17)	-	TT-20	10/8/2008												

Table B.15.1

Summary of ProUCL Input Data for EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				22	23	24	25	26	27	28	29	30	31	32	33
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Lead - coarse fraction	D_Lead - coarse fraction
on-site (EU17)	0-2 ft BGS	SS-1	11/9/2017	4.2	1	24	1	0.5	0	11000	1	58	1	65	1
on-site (EU17)	0.2-2.2 ft BGS	SS-2	11/9/2017	12	1	1600	1	0.63	0	10000	1	190	1		
on-site (EU17)	0.3-2.3 ft BGS	SS-3	11/9/2017	13.5	1	264.5	1	13	1	21150	1	430	1	690	1
on-site (EU17)	0-2 ft BGS	SS-4	12/20/2018	5.2	1	40	1			14000	1	51	1		
on-site (EU17)	0.33-2.33 ft BGS	SS-5	12/20/2018	38	1	685	1	6.8	1	36000	1	305	1		
on-site (EU17)	0.33-2.33 ft BGS	SS-6	12/20/2018	23	1	6000	1	0.88	1	30000	1	2400	1	4500	1
on-site (EU17)	0-2 ft BGS	SS-7	12/20/2018	6.9	1	930	1	0.49	1	19000	1	930	1		
on-site (EU17)	0-2 ft BGS	SS-8	12/20/2018	9.9	1	310	1	0.29	1	21000	1	450	1	320	1
on-site (EU17)	0-2 ft BGS	SS-9	12/20/2018	6.7	1	53	1			18000	1	60	1		
on-site (EU17)	0-2 ft BGS	SS-10	12/20/2018	7.9	1	19	1			20000	1	20	1	20	1
on-site (EU17)	0-2 ft BGS	SS-11	12/20/2018	5.3	1	25	1			14000	1	68	1		
on-site (EU17)	0-2 ft BGS	SS-95	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-96	12/20/2018												
on-site (EU17)	0.33-2.33 ft BGS	SS-97	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-127	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-128	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-129	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-174-AS	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-175-AS	11/27/2018												
on-site (EU17)	0.33-0.83 ft BGS	SS-176-AS	11/27/2018												
on-site (EU17)	0-0.5 ft BGS	SS-177-AS	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-178-AS	12/20/2018												
on-site (EU17)	0-2 ft BGS	TP-9	11/9/2017												
on-site (EU17)	-	TT-20	10/8/2008												

Table B.15.1

Summary of ProUCL Input Data for EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				34	35	36	37	38	39	40	41
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)	Manganese	D_Manganese	Nickel	D_Nickel
on-site (EU17)	0-2 ft BGS	SS-1	11/9/2017	110	1	73	1	350	1	11	1
on-site (EU17)	0.2-2.2 ft BGS	SS-2	11/9/2017					140	1	30	1
on-site (EU17)	0.3-2.3 ft BGS	SS-3	11/9/2017	920	1	740	1	510	1	33.5	1
on-site (EU17)	0-2 ft BGS	SS-4	12/20/2018					430	1	15	1
on-site (EU17)	0.33-2.33 ft BGS	SS-5	12/20/2018					500	1	96.5	1
on-site (EU17)	0.33-2.33 ft BGS	SS-6	12/20/2018	2500	1	4100	1	760	1	330	1
on-site (EU17)	0-2 ft BGS	SS-7	12/20/2018					330	1	60	1
on-site (EU17)	0-2 ft BGS	SS-8	12/20/2018	300	1	320	1	540	1	43	1
on-site (EU17)	0-2 ft BGS	SS-9	12/20/2018					530	1	19	1
on-site (EU17)	0-2 ft BGS	SS-10	12/20/2018	47	1	22	1	760	1	19	1
on-site (EU17)	0-2 ft BGS	SS-11	12/20/2018					320	1	17	1
on-site (EU17)	0-2 ft BGS	SS-95	12/20/2018								
on-site (EU17)	0-2 ft BGS	SS-96	12/20/2018								
on-site (EU17)	0.33-2.33 ft BGS	SS-97	12/20/2018								
on-site (EU17)	0-2 ft BGS	SS-127	12/20/2018								
on-site (EU17)	0-2 ft BGS	SS-128	12/20/2018								
on-site (EU17)	0-2 ft BGS	SS-129	12/20/2018								
on-site (EU17)	0-0.5 ft BGS	SS-174-AS	12/20/2018								
on-site (EU17)	0-0.5 ft BGS	SS-175-AS	11/27/2018								
on-site (EU17)	0.33-0.83 ft BGS	SS-176-AS	11/27/2018								
on-site (EU17)	0-0.5 ft BGS	SS-177-AS	12/20/2018								
on-site (EU17)	0-0.5 ft BGS	SS-178-AS	12/20/2018								
on-site (EU17)	0-2 ft BGS	TP-9	11/9/2017								
on-site (EU17)	-	TT-20	10/8/2008								

Table B.15.1

Summary of ProUCL Input Data for EU17 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				42	43	44	45	46	47	48	49
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
on-site (EU17)	0-2 ft BGS	SS-1	11/9/2017	0.16	1	15	1	90	1	15	0
on-site (EU17)	0.2-2.2 ft BGS	SS-2	11/9/2017	0.51	1	35	1	920	1	120	1
on-site (EU17)	0.3-2.3 ft BGS	SS-3	11/9/2017	0.335	1	19.5	1	845	1	51.5	1
on-site (EU17)	0-2 ft BGS	SS-4	12/20/2018	0.2	1	16	1	110	1	57	1
on-site (EU17)	0.33-2.33 ft BGS	SS-5	12/20/2018	0.1455	1	19.5	1	465	1	670	1
on-site (EU17)	0.33-2.33 ft BGS	SS-6	12/20/2018	0.41	1	42	1	4500	1	1200	1
on-site (EU17)	0-2 ft BGS	SS-7	12/20/2018	0.17	1	16	1	780	1	170	1
on-site (EU17)	0-2 ft BGS	SS-8	12/20/2018	0.22	1	28	1	280	1	1700	1
on-site (EU17)	0-2 ft BGS	SS-9	12/20/2018	0.12	1	27	1	110	1	53	1
on-site (EU17)	0-2 ft BGS	SS-10	12/20/2018	0.085	1	29	1	59	1	27	0
on-site (EU17)	0-2 ft BGS	SS-11	12/20/2018	0.29	1	18	1	79	1	41	1
on-site (EU17)	0-2 ft BGS	SS-95	12/20/2018								
on-site (EU17)	0-2 ft BGS	SS-96	12/20/2018								
on-site (EU17)	0.33-2.33 ft BGS	SS-97	12/20/2018								
on-site (EU17)	0-2 ft BGS	SS-127	12/20/2018								
on-site (EU17)	0-2 ft BGS	SS-128	12/20/2018								
on-site (EU17)	0-2 ft BGS	SS-129	12/20/2018								
on-site (EU17)	0-0.5 ft BGS	SS-174-AS	12/20/2018								
on-site (EU17)	0-0.5 ft BGS	SS-175-AS	11/27/2018								
on-site (EU17)	0.33-0.83 ft BGS	SS-176-AS	11/27/2018								
on-site (EU17)	0-0.5 ft BGS	SS-177-AS	12/20/2018								
on-site (EU17)	0-0.5 ft BGS	SS-178-AS	12/20/2018								
on-site (EU17)	0-2 ft BGS	TP-9	11/9/2017								
on-site (EU17)	-	TT-20	10/8/2008							38	0

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	24	Mean	372.4
Maximum	970	Median	230
SD	341.9	Std. Error of Mean	103.1
Coefficient of Variation	0.918	Skewness	0.96

Normal GOF Test

Shapiro Wilk Test Statistic	0.842	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.243	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	559.2	95% Adjusted-CLT UCL (Chen-1995)	573.8
		95% Modified-t UCL (Johnson-1978)	564.1

Gamma GOF Test

A-D Test Statistic	0.283	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.132	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.261	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.189	k star (bias corrected MLE)	0.925
Theta hat (MLE)	313.3	Theta star (bias corrected MLE)	402.6
nu hat (MLE)	26.15	nu star (bias corrected)	20.35
MLE Mean (bias corrected)	372.4	MLE Sd (bias corrected)	387.2
		Approximate Chi Square Value (0.05)	11.11
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	10.01

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	682.1	95% Adjusted Gamma UCL (use when n<50)	756.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.137	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.178	Mean of logged Data	5.443
Maximum of Logged Data	6.877	SD of logged Data	1.129

Assuming Lognormal Distribution

95% H-UCL	1396	90% Chebyshev (MVUE) UCL	841
95% Chebyshev (MVUE) UCL	1040	97.5% Chebyshev (MVUE) UCL	1315
99% Chebyshev (MVUE) UCL	1857		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	541.9	95% Jackknife UCL	559.2
95% Standard Bootstrap UCL	535.7	95% Bootstrap-t UCL	633.4
95% Hall's Bootstrap UCL	578.2	95% Percentile Bootstrap UCL	529.4
95% BCA Bootstrap UCL	550.9		
90% Chebyshev(Mean, Sd) UCL	681.6	95% Chebyshev(Mean, Sd) UCL	821.6
97.5% Chebyshev(Mean, Sd) UCL	1016	99% Chebyshev(Mean, Sd) UCL	1398

Suggested UCL to Use

95% Student's-t UCL	559.2

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	24	Mean	370.9
Maximum	1000	Median	270
SD	328.3	Std. Error of Mean	98.99
Coefficient of Variation	0.885	Skewness	0.996

Normal GOF Test

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.21	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	550.3	95% Adjusted-CLT UCL (Chen-1995)	565.5
		95% Modified-t UCL (Johnson-1978)	555.3

Gamma GOF Test

A-D Test Statistic	0.191	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.135	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.261	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.253	k star (bias corrected MLE)	0.972
Theta hat (MLE)	295.9	Theta star (bias corrected MLE)	381.6
nu hat (MLE)	27.57	nu star (bias corrected)	21.39
MLE Mean (bias corrected)	370.9	MLE Sd (bias corrected)	376.2
		Approximate Chi Square Value (0.05)	11.88
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	10.74

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	667.7	95% Adjusted Gamma UCL (use when n<50)	738.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.117	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.178	Mean of logged Data	5.467
Maximum of Logged Data	6.908	SD of logged Data	1.11

Assuming Lognormal Distribution

95% H-UCL	1352	90% Chebyshev (MVUE) UCL	837.4
95% Chebyshev (MVUE) UCL	1034	97.5% Chebyshev (MVUE) UCL	1306
99% Chebyshev (MVUE) UCL	1840		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	533.7	95% Jackknife UCL	550.3
95% Standard Bootstrap UCL	523.1	95% Bootstrap-t UCL	639.7
95% Hall's Bootstrap UCL	591.4	95% Percentile Bootstrap UCL	539
95% BCA Bootstrap UCL	547.7		
90% Chebyshev(Mean, Sd) UCL	667.9	95% Chebyshev(Mean, Sd) UCL	802.4
97.5% Chebyshev(Mean, Sd) UCL	989.1	99% Chebyshev(Mean, Sd) UCL	1356

Suggested UCL to Use

95% Student's-t UCL	550.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	37	Mean	578.8
Maximum	1600	Median	370
SD	520.4	Std. Error of Mean	156.9
Coefficient of Variation	0.899	Skewness	1.032

Normal GOF Test

Shapiro Wilk Test Statistic	0.865	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.242	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	863.2	95% Adjusted-CLT UCL (Chen-1995)	889.1
		95% Modified-t UCL (Johnson-1978)	871.3

Gamma GOF Test

A-D Test Statistic	0.246	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.131	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.261	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.254	k star (bias corrected MLE)	0.973
Theta hat (MLE)	461.4	Theta star (bias corrected MLE)	594.9
nu hat (MLE)	27.6	nu star (bias corrected)	21.4
MLE Mean (bias corrected)	578.8	MLE Sd (bias corrected)	586.8
		Approximate Chi Square Value (0.05)	11.89
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	10.75

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1042	95% Adjusted Gamma UCL (use when n<50)	1152

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.949	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.149	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.611	Mean of logged Data	5.912
Maximum of Logged Data	7.378	SD of logged Data	1.101

Assuming Lognormal Distribution

95% H-UCL	2061	90% Chebyshev (MVUE) UCL	1292
95% Chebyshev (MVUE) UCL	1593	97.5% Chebyshev (MVUE) UCL	2011
99% Chebyshev (MVUE) UCL	2833		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	836.9	95% Jackknife UCL	863.2
95% Standard Bootstrap UCL	823.9	95% Bootstrap-t UCL	982.7
95% Hall's Bootstrap UCL	903.4	95% Percentile Bootstrap UCL	834.5
95% BCA Bootstrap UCL	861.5		
90% Chebyshev(Mean, Sd) UCL	1050	95% Chebyshev(Mean, Sd) UCL	1263
97.5% Chebyshev(Mean, Sd) UCL	1559	99% Chebyshev(Mean, Sd) UCL	2140

Suggested UCL to Use

95% Student's-t UCL	863.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
Number of Detects	3	Number of Non-Detects	8
Number of Distinct Detects	3	Number of Distinct Non-Detects	7
Minimum Detect	67	Minimum Non-Detect	21
Maximum Detect	80.5	Maximum Non-Detect	132
Variance Detects	50.25	Percent Non-Detects	72.73%
Mean Detects	72.5	SD Detects	7.089
Median Detects	70	CV Detects	0.0978
Skewness Detects	1.39	Kurtosis Detects	N/A
Mean of Logged Detects	4.28	SD of Logged Detects	0.0959

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.304	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	37.64	KM Standard Error of Mean	9.745
KM SD	24.19	95% KM (BCA) UCL	N/A
95% KM (t) UCL	55.3	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	53.67	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	66.87	95% KM Chebyshev UCL	80.11
97.5% KM Chebyshev UCL	98.49	99% KM Chebyshev UCL	134.6

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	161.2	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.45	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	967.2	nu star (bias corrected)	N/A
Mean (detects)	72.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	47.82	Mean	58.5
Maximum	80.5	Median	55.98
SD	9.887	CV	0.169
k hat (MLE)	42.44	k star (bias corrected MLE)	30.93
Theta hat (MLE)	1.378	Theta star (bias corrected MLE)	1.891
nu hat (MLE)	933.8	nu star (bias corrected)	680.4
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (680.45, α)	620.9	Adjusted Chi Square Value (680.45, β)	611.6
95% Gamma Approximate UCL (use when n>=50)	64.11	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	37.64	SD (KM)	24.19
Variance (KM)	585.4	SE of Mean (KM)	9.745
k hat (KM)	2.42	k star (KM)	1.821
nu hat (KM)	53.24	nu star (KM)	40.05
theta hat (KM)	15.55	theta star (KM)	20.67
80% gamma percentile (KM)	56.97	90% gamma percentile (KM)	74.85
95% gamma percentile (KM)	92	99% gamma percentile (KM)	130.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (40.05, α)	26.55	Adjusted Chi Square Value (40.05, β)	24.77
95% Gamma Approximate KM-UCL (use when n>=50)	56.77	95% Gamma Adjusted KM-UCL (use when n<50)	60.85

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.297	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	59.9	Mean in Log Scale	4.083
SD in Original Scale	8.944	SD in Log Scale	0.139
95% t UCL (assumes normality of ROS data)	64.79	95% Percentile Bootstrap UCL	64.5
95% BCA Bootstrap UCL	65.5	95% Bootstrap t UCL	67.63
95% H-UCL (Log ROS)	64.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.445	KM Geo Mean	31.34
KM SD (logged)	0.579	95% Critical H Value (KM-Log)	2.283
KM Standard Error of Mean (logged)	0.234	95% H-UCL (KM -Log)	56.26
KM SD (logged)	0.579	95% Critical H Value (KM-Log)	2.283
KM Standard Error of Mean (logged)	0.234		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	36.18	Mean in Log Scale	3.268
SD in Original Scale	28.59	SD in Log Scale	0.854
95% t UCL (Assumes normality)	51.8	95% H-Stat UCL	78.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	55.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
Number of Detects	8	Number of Non-Detects	3
Number of Distinct Detects	7	Number of Distinct Non-Detects	3
Minimum Detect	27	Minimum Non-Detect	0.9
Maximum Detect	140	Maximum Non-Detect	8.3
Variance Detects	2037	Percent Non-Detects	27.27%
Mean Detects	78.5	SD Detects	45.13
Median Detects	57	CV Detects	0.575
Skewness Detects	0.475	Kurtosis Detects	-1.931
Mean of Logged Detects	4.208	SD of Logged Detects	0.608

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.844	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.284	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data Not Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	57.34	KM Standard Error of Mean	16.09
KM SD	49.91	95% KM (BCA) UCL	85.51
95% KM (t) UCL	86.49	95% KM (Percentile Bootstrap) UCL	83.53
95% KM (z) UCL	83.8	95% KM Bootstrap t UCL	90.34
90% KM Chebyshev UCL	105.6	95% KM Chebyshev UCL	127.5
97.5% KM Chebyshev UCL	157.8	99% KM Chebyshev UCL	217.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.524	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.72	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.296	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.374	k star (bias corrected MLE)	2.192
Theta hat (MLE)	23.27	Theta star (bias corrected MLE)	35.81
nu hat (MLE)	53.98	nu star (bias corrected)	35.07
Mean (detects)	78.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	57.09
Maximum	140	Median	54
SD	52.63	CV	0.922
k hat (MLE)	0.307	k star (bias corrected MLE)	0.284
Theta hat (MLE)	186.2	Theta star (bias corrected MLE)	201.3
nu hat (MLE)	6.747	nu star (bias corrected)	6.24
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (6.24, α)	1.764	Adjusted Chi Square Value (6.24, β)	1.405
95% Gamma Approximate UCL (use when n>=50)	202	95% Gamma Adjusted UCL (use when n<50)	253.6

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	57.34	SD (KM)	49.91
Variance (KM)	2491	SE of Mean (KM)	16.09
k hat (KM)	1.32	k star (KM)	1.021
nu hat (KM)	29.04	nu star (KM)	22.45
theta hat (KM)	43.44	theta star (KM)	56.18
80% gamma percentile (KM)	92.13	90% gamma percentile (KM)	131.4
95% gamma percentile (KM)	170.5	99% gamma percentile (KM)	261.4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.45, α)	12.68	Adjusted Chi Square Value (22.45, β)	11.5
95% Gamma Approximate KM-UCL (use when n>=50)	101.5	95% Gamma Adjusted KM-UCL (use when n<50)	112

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.218	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	61.37	Mean in Log Scale	3.811
SD in Original Scale	47.82	SD in Log Scale	0.849
95% t UCL (assumes normality of ROS data)	87.5	95% Percentile Bootstrap UCL	83.7
95% BCA Bootstrap UCL	87.76	95% Bootstrap t UCL	96.41
95% H-UCL (Log ROS)	134.3		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.031	KM Geo Mean	20.73
KM SD (logged)	1.981	95% Critical H Value (KM-Log)	5.111
KM Standard Error of Mean (logged)	0.639	95% H-UCL (KM -Log)	3624
KM SD (logged)	1.981	95% Critical H Value (KM-Log)	5.111
KM Standard Error of Mean (logged)	0.639		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	57.86	Mean in Log Scale	3.241
SD in Original Scale	51.73	SD in Log Scale	1.823
95% t UCL (Assumes normality)	86.13	95% H-Stat UCL	2078

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	86.49

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	4600	Mean	7814
Maximum	14000	Median	6300
SD	3316	Std. Error of Mean	999.7
Coefficient of Variation	0.424	Skewness	0.83

Normal GOF Test

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.29	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9626	95% Adjusted-CLT UCL (Chen-1995)	9725
		95% Modified-t UCL (Johnson-1978)	9667

Gamma GOF Test

A-D Test Statistic	0.663	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.267	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.729	k star (bias corrected MLE)	4.954
Theta hat (MLE)	1161	Theta star (bias corrected MLE)	1577
nu hat (MLE)	148	nu star (bias corrected)	109
MLE Mean (bias corrected)	7814	MLE Sd (bias corrected)	3510
		Approximate Chi Square Value (0.05)	85.9
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	82.56

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	9915	95% Adjusted Gamma UCL (use when n<50)	10315

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.242	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.434	Mean of logged Data	8.887
Maximum of Logged Data	9.547	SD of logged Data	0.402

Assuming Lognormal Distribution

95% H-UCL	10190	90% Chebyshev (MVUE) UCL	10657
95% Chebyshev (MVUE) UCL	11957	97.5% Chebyshev (MVUE) UCL	13760
99% Chebyshev (MVUE) UCL	17303		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	9458	95% Jackknife UCL	9626
95% Standard Bootstrap UCL	9381	95% Bootstrap-t UCL	10137
95% Hall's Bootstrap UCL	9288	95% Percentile Bootstrap UCL	9477
95% BCA Bootstrap UCL	9627		
90% Chebyshev(Mean, Sd) UCL	10813	95% Chebyshev(Mean, Sd) UCL	12171
97.5% Chebyshev(Mean, Sd) UCL	14057	99% Chebyshev(Mean, Sd) UCL	17760

Suggested UCL to Use

95% Student's-t UCL	9626

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.2	Mean	34.7
Maximum	260	Median	4.25
SD	78.19	Std. Error of Mean	23.58
Coefficient of Variation	2.253	Skewness	2.881

Normal GOF Test

Shapiro Wilk Test Statistic	0.508	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.418	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	77.43	95% Adjusted-CLT UCL (Chen-1995)	95.36
		95% Modified-t UCL (Johnson-1978)	80.84

Gamma GOF Test

A-D Test Statistic	0.811	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.811	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.266	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.274	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.349	k star (bias corrected MLE)	0.315
Theta hat (MLE)	99.39	Theta star (bias corrected MLE)	110.3
nu hat (MLE)	7.68	nu star (bias corrected)	6.919
MLE Mean (bias corrected)	34.7	MLE Sd (bias corrected)	61.87
		Approximate Chi Square Value (0.05)	2.126
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	1.721

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	112.9	95% Adjusted Gamma UCL (use when n<50)	139.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.133	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.609	Mean of logged Data	1.62
Maximum of Logged Data	5.561	SD of logged Data	2.092

Assuming Lognormal Distribution

95% H-UCL	1566	90% Chebyshev (MVUE) UCL	86.32
95% Chebyshev (MVUE) UCL	112.3	97.5% Chebyshev (MVUE) UCL	148.4
99% Chebyshev (MVUE) UCL	219.3		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	73.48	95% Jackknife UCL	77.43
95% Standard Bootstrap UCL	71.64	95% Bootstrap-t UCL	553.4
95% Hall's Bootstrap UCL	340.8	95% Percentile Bootstrap UCL	77.53
95% BCA Bootstrap UCL	104.3		
90% Chebyshev(Mean, Sd) UCL	105.4	95% Chebyshev(Mean, Sd) UCL	137.5
97.5% Chebyshev(Mean, Sd) UCL	181.9	99% Chebyshev(Mean, Sd) UCL	269.3

Suggested UCL to Use

95% Adjusted Gamma UCL	139.5

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	6.2	Mean	14.54
Maximum	29	Median	14
SD	7.249	Std. Error of Mean	2.186
Coefficient of Variation	0.499	Skewness	0.889

Normal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	18.5	95% Adjusted-CLT UCL (Chen-1995)	18.76
		95% Modified-t UCL (Johnson-1978)	18.6

Gamma GOF Test

A-D Test Statistic	0.332	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.732	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.651	k star (bias corrected MLE)	3.444
Theta hat (MLE)	3.125	Theta star (bias corrected MLE)	4.221
nu hat (MLE)	102.3	nu star (bias corrected)	75.76
MLE Mean (bias corrected)	14.54	MLE Sd (bias corrected)	7.833
		Approximate Chi Square Value (0.05)	56.71
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	54.03

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	19.42	95% Adjusted Gamma UCL (use when n<50)	20.38

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.825	Mean of logged Data	2.565
Maximum of Logged Data	3.367	SD of logged Data	0.497

Assuming Lognormal Distribution

95% H-UCL	20.72	90% Chebyshev (MVUE) UCL	21.22
95% Chebyshev (MVUE) UCL	24.24	97.5% Chebyshev (MVUE) UCL	28.44
99% Chebyshev (MVUE) UCL	36.69		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	18.13	95% Jackknife UCL	18.5
95% Standard Bootstrap UCL	18	95% Bootstrap-t UCL	19.87
95% Hall's Bootstrap UCL	22.29	95% Percentile Bootstrap UCL	18.09
95% BCA Bootstrap UCL	18.48		
90% Chebyshev(Mean, Sd) UCL	21.09	95% Chebyshev(Mean, Sd) UCL	24.06
97.5% Chebyshev(Mean, Sd) UCL	28.19	99% Chebyshev(Mean, Sd) UCL	36.28

Suggested UCL to Use

95% Student's-t UCL	18.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	86	Mean	554.4
Maximum	1800	Median	400
SD	533.2	Std. Error of Mean	160.8
Coefficient of Variation	0.962	Skewness	1.649

Normal GOF Test

Shapiro Wilk Test Statistic	0.793	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.277	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	845.7	95% Adjusted-CLT UCL (Chen-1995)	904.2
		95% Modified-t UCL (Johnson-1978)	859.1

Gamma GOF Test

A-D Test Statistic	0.386	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.163	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.26	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.359	k star (bias corrected MLE)	1.049
Theta hat (MLE)	407.9	Theta star (bias corrected MLE)	528.5
nu hat (MLE)	29.9	nu star (bias corrected)	23.08
MLE Mean (bias corrected)	554.4	MLE Sd (bias corrected)	541.3
		Approximate Chi Square Value (0.05)	13.15
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	11.94

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	972.9	95% Adjusted Gamma UCL (use when n<50)	1071

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.454	Mean of logged Data	5.907
Maximum of Logged Data	7.496	SD of logged Data	0.991

Assuming Lognormal Distribution

95% H-UCL	1529	90% Chebyshev (MVUE) UCL	1103
95% Chebyshev (MVUE) UCL	1346	97.5% Chebyshev (MVUE) UCL	1684
99% Chebyshev (MVUE) UCL	2347		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	818.8	95% Jackknife UCL	845.7
95% Standard Bootstrap UCL	806.3	95% Bootstrap-t UCL	1213
95% Hall's Bootstrap UCL	2563	95% Percentile Bootstrap UCL	818.4
95% BCA Bootstrap UCL	890.6		
90% Chebyshev(Mean, Sd) UCL	1037	95% Chebyshev(Mean, Sd) UCL	1255
97.5% Chebyshev(Mean, Sd) UCL	1558	99% Chebyshev(Mean, Sd) UCL	2154

Suggested UCL to Use

95% Adjusted Gamma UCL	1071

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.24	Mean	4.467
Maximum	20	Median	2.895
SD	6.024	Std. Error of Mean	1.816
Coefficient of Variation	1.349	Skewness	2.025

Normal GOF Test

Shapiro Wilk Test Statistic	0.737	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7.759	95% Adjusted-CLT UCL (Chen-1995)	8.639
		95% Modified-t UCL (Johnson-1978)	7.944

Gamma GOF Test

A-D Test Statistic	0.401	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.767	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.204	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.688	k star (bias corrected MLE)	0.561
Theta hat (MLE)	6.496	Theta star (bias corrected MLE)	7.967
nu hat (MLE)	15.13	nu star (bias corrected)	12.33
MLE Mean (bias corrected)	4.467	MLE Sd (bias corrected)	5.965
		Approximate Chi Square Value (0.05)	5.448
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	4.723

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	10.11	95% Adjusted Gamma UCL (use when n<50)	11.66

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.427	Mean of logged Data	0.616
Maximum of Logged Data	2.996	SD of logged Data	1.484

Assuming Lognormal Distribution

95% H-UCL	36.27	90% Chebyshev (MVUE) UCL	11.47
95% Chebyshev (MVUE) UCL	14.53	97.5% Chebyshev (MVUE) UCL	18.79
99% Chebyshev (MVUE) UCL	27.16		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7.454	95% Jackknife UCL	7.759
95% Standard Bootstrap UCL	7.367	95% Bootstrap-t UCL	11.19
95% Hall's Bootstrap UCL	19.64	95% Percentile Bootstrap UCL	7.562
95% BCA Bootstrap UCL	8.626		
90% Chebyshev(Mean, Sd) UCL	9.916	95% Chebyshev(Mean, Sd) UCL	12.38
97.5% Chebyshev(Mean, Sd) UCL	15.81	99% Chebyshev(Mean, Sd) UCL	22.54

Suggested UCL to Use

95% Adjusted Gamma UCL	11.66

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI

General Statistics

Total Number of Observations	11	Number of Distinct Observations	9
Number of Detects	5	Number of Non-Detects	6
Number of Distinct Detects	5	Number of Distinct Non-Detects	4
Minimum Detect	0.31	Minimum Non-Detect	1.4
Maximum Detect	3.9	Maximum Non-Detect	3.3
Variance Detects	2.829	Percent Non-Detects	54.55%
Mean Detects	1.976	SD Detects	1.682
Median Detects	1.3	CV Detects	0.851
Skewness Detects	0.429	Kurtosis Detects	-3.007
Mean of Logged Detects	0.284	SD of Logged Detects	1.081

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.846	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.322	KM Standard Error of Mean	0.445
KM SD	1.215	95% KM (BCA) UCL	2.061
95% KM (t) UCL	2.129	95% KM (Percentile Bootstrap) UCL	2.077
95% KM (z) UCL	2.054	95% KM Bootstrap t UCL	2.545
90% KM Chebyshev UCL	2.658	95% KM Chebyshev UCL	3.263
97.5% KM Chebyshev UCL	4.103	99% KM Chebyshev UCL	5.753

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.346	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.687	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.26	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.362	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.401	k star (bias corrected MLE)	0.694
Theta hat (MLE)	1.41	Theta star (bias corrected MLE)	2.848
nu hat (MLE)	14.01	nu star (bias corrected)	6.939
Mean (detects)	1.976		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.251	Mean	1.34
Maximum	3.9	Median	0.784
SD	1.256	CV	0.937
k hat (MLE)	1.605	k star (bias corrected MLE)	1.228
Theta hat (MLE)	0.835	Theta star (bias corrected MLE)	1.091
nu hat (MLE)	35.32	nu star (bias corrected)	27.02
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (27.02, α)	16.17	Adjusted Chi Square Value (27.02, β)	14.81
95% Gamma Approximate UCL (use when n>=50)	2.239	95% Gamma Adjusted UCL (use when n<50)	2.444

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.322	SD (KM)	1.215
Variance (KM)	1.475	SE of Mean (KM)	0.445
k hat (KM)	1.184	k star (KM)	0.922
nu hat (KM)	26.06	nu star (KM)	20.28
theta hat (KM)	1.116	theta star (KM)	1.434
80% gamma percentile (KM)	2.141	90% gamma percentile (KM)	3.105
95% gamma percentile (KM)	4.076	99% gamma percentile (KM)	6.343

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.28, α)	11.06	Adjusted Chi Square Value (20.28, β)	9.967
95% Gamma Approximate KM-UCL (use when n>=50)	2.424	95% Gamma Adjusted KM-UCL (use when n<50)	2.69

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.225	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.283	Mean in Log Scale	-0.0945
SD in Original Scale	1.268	SD in Log Scale	0.821
95% t UCL (assumes normality of ROS data)	1.976	95% Percentile Bootstrap UCL	1.909
95% BCA Bootstrap UCL	2.137	95% Bootstrap t UCL	3.627
95% H-UCL (Log ROS)	2.545		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.096	KM Geo Mean	0.908
KM SD (logged)	0.857	95% Critical H Value (KM-Log)	2.731
KM Standard Error of Mean (logged)	0.384	95% H-UCL (KM -Log)	2.748
KM SD (logged)	0.857	95% Critical H Value (KM-Log)	2.731
KM Standard Error of Mean (logged)	0.384		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.448	Mean in Log Scale	0.0982
SD in Original Scale	1.214	SD in Log Scale	0.757
95% t UCL (Assumes normality)	2.111	95% H-Stat UCL	2.71

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.129

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	4.2	Mean	12.05
Maximum	38	Median	7.9
SD	10.13	Std. Error of Mean	3.055
Coefficient of Variation	0.84	Skewness	2.032

Normal GOF Test

Shapiro Wilk Test Statistic	0.745	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.261	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	17.59	95% Adjusted-CLT UCL (Chen-1995)	19.08
		95% Modified-t UCL (Johnson-1978)	17.9

Gamma GOF Test

A-D Test Statistic	0.581	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.737	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.258	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.286	k star (bias corrected MLE)	1.723
Theta hat (MLE)	5.274	Theta star (bias corrected MLE)	6.997
nu hat (MLE)	50.28	nu star (bias corrected)	37.9
MLE Mean (bias corrected)	12.05	MLE Sd (bias corrected)	9.184
		Approximate Chi Square Value (0.05)	24.81
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	23.09

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	18.42	95% Adjusted Gamma UCL (use when n<50)	19.79

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.156	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.435	Mean of logged Data	2.255
Maximum of Logged Data	3.638	SD of logged Data	0.672

Assuming Lognormal Distribution

95% H-UCL	19.98	90% Chebyshev (MVUE) UCL	19
95% Chebyshev (MVUE) UCL	22.32	97.5% Chebyshev (MVUE) UCL	26.93
99% Chebyshev (MVUE) UCL	35.99		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	17.08	95% Jackknife UCL	17.59
95% Standard Bootstrap UCL	16.85	95% Bootstrap-t UCL	25.67
95% Hall's Bootstrap UCL	41.21	95% Percentile Bootstrap UCL	16.96
95% BCA Bootstrap UCL	19.16		
90% Chebyshev(Mean, Sd) UCL	21.22	95% Chebyshev(Mean, Sd) UCL	25.37
97.5% Chebyshev(Mean, Sd) UCL	31.13	99% Chebyshev(Mean, Sd) UCL	42.45

Suggested UCL to Use

95% Adjusted Gamma UCL	19.79

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	19	Mean	904.6
Maximum	6000	Median	264.5
SD	1763	Std. Error of Mean	531.4
Coefficient of Variation	1.948	Skewness	2.876

Normal GOF Test

Shapiro Wilk Test Statistic	0.564	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1868	95% Adjusted-CLT UCL (Chen-1995)	2271
		95% Modified-t UCL (Johnson-1978)	1945

Gamma GOF Test

A-D Test Statistic	0.58	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.797	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.218	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.272	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.419	k star (bias corrected MLE)	0.366
Theta hat (MLE)	2157	Theta star (bias corrected MLE)	2474
nu hat (MLE)	9.228	nu star (bias corrected)	8.045
MLE Mean (bias corrected)	904.6	MLE Sd (bias corrected)	1496
		Approximate Chi Square Value (0.05)	2.761
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	2.282

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	2636	95% Adjusted Gamma UCL (use when n<50)	3189

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.944	Mean of logged Data	5.251
Maximum of Logged Data	8.7	SD of logged Data	1.968

Assuming Lognormal Distribution

95% H-UCL	31223	90% Chebyshev (MVUE) UCL	2627
95% Chebyshev (MVUE) UCL	3405	97.5% Chebyshev (MVUE) UCL	4484
99% Chebyshev (MVUE) UCL	6604		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1779	95% Jackknife UCL	1868
95% Standard Bootstrap UCL	1722	95% Bootstrap-t UCL	4723
95% Hall's Bootstrap UCL	4949	95% Percentile Bootstrap UCL	1898
95% BCA Bootstrap UCL	2451		
90% Chebyshev(Mean, Sd) UCL	2499	95% Chebyshev(Mean, Sd) UCL	3221
97.5% Chebyshev(Mean, Sd) UCL	4223	99% Chebyshev(Mean, Sd) UCL	6192

Suggested UCL to Use

95% Adjusted Gamma UCL	3189

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	1
Number of Detects	5	Number of Non-Detects	2
Number of Distinct Detects	5	Number of Distinct Non-Detects	2
Minimum Detect	0.29	Minimum Non-Detect	0.5
Maximum Detect	13	Maximum Non-Detect	0.63
Variance Detects	31.06	Percent Non-Detects	28.57%
Mean Detects	4.292	SD Detects	5.573
Median Detects	0.88	CV Detects	1.298
Skewness Detects	1.245	Kurtosis Detects	0.281
Mean of Logged Detects	0.481	SD of Logged Detects	1.67

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.8	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.33	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.177	KM Standard Error of Mean	1.93
KM SD	4.567	95% KM (BCA) UCL	6.784
95% KM (t) UCL	6.928	95% KM (Percentile Bootstrap) UCL	6.667
95% KM (z) UCL	6.352	95% KM Bootstrap t UCL	54.45
90% KM Chebyshev UCL	8.968	95% KM Chebyshev UCL	11.59
97.5% KM Chebyshev UCL	15.23	99% KM Chebyshev UCL	22.38

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.444	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.704	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.307	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.369	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.629	k star (bias corrected MLE)	0.385
Theta hat (MLE)	6.827	Theta star (bias corrected MLE)	11.15
nu hat (MLE)	6.286	nu star (bias corrected)	3.848
Mean (detects)	4.292		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.069
Maximum	13	Median	0.49
SD	5.007	CV	1.632
k hat (MLE)	0.325	k star (bias corrected MLE)	0.281
Theta hat (MLE)	9.44	Theta star (bias corrected MLE)	10.92
nu hat (MLE)	4.551	nu star (bias corrected)	3.934
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (3.93, α)	0.696	Adjusted Chi Square Value (3.93, β)	0.383
95% Gamma Approximate UCL (use when n>=50)	17.35	95% Gamma Adjusted UCL (use when n<50)	31.55

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.177	SD (KM)	4.567
Variance (KM)	20.86	SE of Mean (KM)	1.93
k hat (KM)	0.484	k star (KM)	0.372
nu hat (KM)	6.775	nu star (KM)	5.205
theta hat (KM)	6.565	theta star (KM)	8.546
80% gamma percentile (KM)	5.079	90% gamma percentile (KM)	9.087
95% gamma percentile (KM)	13.54	99% gamma percentile (KM)	24.81

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.21, α)	1.248	Adjusted Chi Square Value (5.21, β)	0.759
95% Gamma Approximate KM-UCL (use when n>=50)	13.25	95% Gamma Adjusted KM-UCL (use when n<50)	21.78

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.242	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.167	Mean in Log Scale	0.0459
SD in Original Scale	4.94	SD in Log Scale	1.553
95% t UCL (assumes normality of ROS data)	6.794	95% Percentile Bootstrap UCL	6.694
95% BCA Bootstrap UCL	7.599	95% Bootstrap t UCL	66.22
95% H-UCL (Log ROS)	103.5		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.0645	KM Geo Mean	1.067
KM SD (logged)	1.43	95% Critical H Value (KM-Log)	4.97
KM Standard Error of Mean (logged)	0.61	95% H-UCL (KM -Log)	54.06
KM SD (logged)	1.43	95% Critical H Value (KM-Log)	4.97
KM Standard Error of Mean (logged)	0.61		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.146	Mean in Log Scale	-0.0198
SD in Original Scale	4.953	SD in Log Scale	1.611
95% t UCL (Assumes normality)	6.784	95% H-Stat UCL	135.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	6.928

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	10000	Mean	19468
Maximum	36000	Median	19000
SD	7831	Std. Error of Mean	2361
Coefficient of Variation	0.402	Skewness	0.995

Normal GOF Test

Shapiro Wilk Test Statistic	0.91	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.233	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	23748	95% Adjusted-CLT UCL (Chen-1995)	24109
		95% Modified-t UCL (Johnson-1978)	23866

Gamma GOF Test

A-D Test Statistic	0.289	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.181	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.337	k star (bias corrected MLE)	5.397
Theta hat (MLE)	2653	Theta star (bias corrected MLE)	3607
nu hat (MLE)	161.4	nu star (bias corrected)	118.7
MLE Mean (bias corrected)	19468	MLE Sd (bias corrected)	8380
		Approximate Chi Square Value (0.05)	94.57
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	91.06

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	24442	95% Adjusted Gamma UCL (use when n<50)	25384

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.166	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.21	Mean of logged Data	9.807
Maximum of Logged Data	10.49	SD of logged Data	0.39

Assuming Lognormal Distribution

95% H-UCL	25197	90% Chebyshev (MVUE) UCL	26395
95% Chebyshev (MVUE) UCL	29542	97.5% Chebyshev (MVUE) UCL	33909
99% Chebyshev (MVUE) UCL	42488		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	23352	95% Jackknife UCL	23748
95% Standard Bootstrap UCL	23200	95% Bootstrap-t UCL	25118
95% Hall's Bootstrap UCL	29377	95% Percentile Bootstrap UCL	23405
95% BCA Bootstrap UCL	23832		
90% Chebyshev(Mean, Sd) UCL	26551	95% Chebyshev(Mean, Sd) UCL	29760
97.5% Chebyshev(Mean, Sd) UCL	34213	99% Chebyshev(Mean, Sd) UCL	42961

Suggested UCL to Use

95% Student's-t UCL	23748

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	20	Mean	451.1
Maximum	2400	Median	190
SD	701.3	Std. Error of Mean	211.4
Coefficient of Variation	1.555	Skewness	2.541

Normal GOF Test

Shapiro Wilk Test Statistic	0.646	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	834.3	95% Adjusted-CLT UCL (Chen-1995)	972
		95% Modified-t UCL (Johnson-1978)	861.3

Gamma GOF Test

A-D Test Statistic	0.497	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.769	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.222	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.659	k star (bias corrected MLE)	0.54
Theta hat (MLE)	684.1	Theta star (bias corrected MLE)	835.1
nu hat (MLE)	14.51	nu star (bias corrected)	11.88
MLE Mean (bias corrected)	451.1	MLE Sd (bias corrected)	613.8
		Approximate Chi Square Value (0.05)	5.15
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	4.449

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1041	95% Adjusted Gamma UCL (use when n<50)	1205

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.955	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.202	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.996	Mean of logged Data	5.187
Maximum of Logged Data	7.783	SD of logged Data	1.454

Assuming Lognormal Distribution

95% H-UCL	3142	90% Chebyshev (MVUE) UCL	1059
95% Chebyshev (MVUE) UCL	1340	97.5% Chebyshev (MVUE) UCL	1730
99% Chebyshev (MVUE) UCL	2496		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	798.9	95% Jackknife UCL	834.3
95% Standard Bootstrap UCL	785.9	95% Bootstrap-t UCL	1658
95% Hall's Bootstrap UCL	2294	95% Percentile Bootstrap UCL	832.4
95% BCA Bootstrap UCL	1002		
90% Chebyshev(Mean, Sd) UCL	1085	95% Chebyshev(Mean, Sd) UCL	1373
97.5% Chebyshev(Mean, Sd) UCL	1772	99% Chebyshev(Mean, Sd) UCL	2555

Suggested UCL to Use

95% Adjusted Gamma UCL	1205

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	20	Mean	1119
Maximum	4500	Median	320
SD	1909	Std. Error of Mean	853.6
Coefficient of Variation	1.706	Skewness	2.131

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.672	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.389	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2939	95% Adjusted-CLT UCL (Chen-1995)	3392
		95% Modified-t UCL (Johnson-1978)	3074

Gamma GOF Test

A-D Test Statistic	0.293	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.216	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.374	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.448	k star (bias corrected MLE)	0.312
Theta hat (MLE)	2498	Theta star (bias corrected MLE)	3581
nu hat (MLE)	4.479	nu star (bias corrected)	3.125
MLE Mean (bias corrected)	1119	MLE Sd (bias corrected)	2002
		Approximate Chi Square Value (0.05)	0.41
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.154

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	8521	95% Adjusted Gamma UCL (use when n<50)	22706

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.986	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.148	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.996	Mean of logged Data	5.577
Maximum of Logged Data	8.412	SD of logged Data	2.099

Assuming Lognormal Distribution

95% H-UCL	73004129	90% Chebyshev (MVUE) UCL	3609
95% Chebyshev (MVUE) UCL	4745	97.5% Chebyshev (MVUE) UCL	6322
99% Chebyshev (MVUE) UCL	9419		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2523	95% Jackknife UCL	2939
95% Standard Bootstrap UCL	2409	95% Bootstrap-t UCL	13428
95% Hall's Bootstrap UCL	12651	95% Percentile Bootstrap UCL	2717
95% BCA Bootstrap UCL	2851		
90% Chebyshev(Mean, Sd) UCL	3680	95% Chebyshev(Mean, Sd) UCL	4840
97.5% Chebyshev(Mean, Sd) UCL	6450	99% Chebyshev(Mean, Sd) UCL	9612

Suggested UCL to Use

95% Adjusted Gamma UCL	22706

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	47	Mean	775.4
Maximum	2500	Median	300
SD	1024	Std. Error of Mean	458
Coefficient of Variation	1.321	Skewness	1.686

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.795	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1752	95% Adjusted-CLT UCL (Chen-1995)	1898
		95% Modified-t UCL (Johnson-1978)	1809

Gamma GOF Test

A-D Test Statistic	0.247	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.701	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.368	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.693	k star (bias corrected MLE)	0.411
Theta hat (MLE)	1118	Theta star (bias corrected MLE)	1888
nu hat (MLE)	6.933	nu star (bias corrected)	4.107
MLE Mean (bias corrected)	775.4	MLE Sd (bias corrected)	1210
		Approximate Chi Square Value (0.05)	0.764
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.319

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4166	95% Adjusted Gamma UCL (use when n<50)	9976

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.85	Mean of logged Data	5.781
Maximum of Logged Data	7.824	SD of logged Data	1.594

Assuming Lognormal Distribution

95% H-UCL	471618	90% Chebyshev (MVUE) UCL	2277
95% Chebyshev (MVUE) UCL	2952	97.5% Chebyshev (MVUE) UCL	3889
99% Chebyshev (MVUE) UCL	5730		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1529	95% Jackknife UCL	1752
95% Standard Bootstrap UCL	1435	95% Bootstrap-t UCL	5982
95% Hall's Bootstrap UCL	7357	95% Percentile Bootstrap UCL	1531
95% BCA Bootstrap UCL	1706		
90% Chebyshev(Mean, Sd) UCL	2149	95% Chebyshev(Mean, Sd) UCL	2772
97.5% Chebyshev(Mean, Sd) UCL	3635	99% Chebyshev(Mean, Sd) UCL	5332

Suggested UCL to Use

95% Student's-t UCL	1752

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	22	Mean	1051
Maximum	4100	Median	320
SD	1728	Std. Error of Mean	772.7
Coefficient of Variation	1.644	Skewness	2.092

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.69	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2698	95% Adjusted-CLT UCL (Chen-1995)	3094
		95% Modified-t UCL (Johnson-1978)	2819

Gamma GOF Test

A-D Test Statistic	0.271	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.195	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.373	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.477	k star (bias corrected MLE)	0.324
Theta hat (MLE)	2205	Theta star (bias corrected MLE)	3244
nu hat (MLE)	4.767	nu star (bias corrected)	3.24
MLE Mean (bias corrected)	1051	MLE Sd (bias corrected)	1846
		Approximate Chi Square Value (0.05)	0.447
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.169

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	7619	95% Adjusted Gamma UCL (use when n<50)	20150

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.989	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.091	Mean of logged Data	5.615
Maximum of Logged Data	8.319	SD of logged Data	2.027

Assuming Lognormal Distribution

95% H-UCL	33021031	90% Chebyshev (MVUE) UCL	3406
95% Chebyshev (MVUE) UCL	4471	97.5% Chebyshev (MVUE) UCL	5950
99% Chebyshev (MVUE) UCL	8855		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2322	95% Jackknife UCL	2698
95% Standard Bootstrap UCL	2168	95% Bootstrap-t UCL	11571
95% Hall's Bootstrap UCL	11371	95% Percentile Bootstrap UCL	2528
95% BCA Bootstrap UCL	2623		
90% Chebyshev(Mean, Sd) UCL	3369	95% Chebyshev(Mean, Sd) UCL	4419
97.5% Chebyshev(Mean, Sd) UCL	5877	99% Chebyshev(Mean, Sd) UCL	8740

Suggested UCL to Use

95% Adjusted Gamma UCL	20150

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	140	Mean	470
Maximum	760	Median	500
SD	186.1	Std. Error of Mean	56.1
Coefficient of Variation	0.396	Skewness	0.106

Normal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	571.7	95% Adjusted-CLT UCL (Chen-1995)	564.2
		95% Modified-t UCL (Johnson-1978)	572

Gamma GOF Test

A-D Test Statistic	0.366	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.731	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.159	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.836	k star (bias corrected MLE)	4.305
Theta hat (MLE)	80.53	Theta star (bias corrected MLE)	109.2
nu hat (MLE)	128.4	nu star (bias corrected)	94.72
MLE Mean (bias corrected)	470	MLE Sd (bias corrected)	226.5
		Approximate Chi Square Value (0.05)	73.27
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	70.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	607.6	95% Adjusted Gamma UCL (use when n<50)	634.1

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.175	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.942	Mean of logged Data	6.065
Maximum of Logged Data	6.633	SD of logged Data	0.475

Assuming Lognormal Distribution

95% H-UCL	664.7	90% Chebyshev (MVUE) UCL	685
95% Chebyshev (MVUE) UCL	779.4	97.5% Chebyshev (MVUE) UCL	910.6
99% Chebyshev (MVUE) UCL	1168		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	562.3	95% Jackknife UCL	571.7
95% Standard Bootstrap UCL	555.9	95% Bootstrap-t UCL	579
95% Hall's Bootstrap UCL	587.6	95% Percentile Bootstrap UCL	561.8
95% BCA Bootstrap UCL	557.3		
90% Chebyshev(Mean, Sd) UCL	638.3	95% Chebyshev(Mean, Sd) UCL	714.5
97.5% Chebyshev(Mean, Sd) UCL	820.3	99% Chebyshev(Mean, Sd) UCL	1028

Suggested UCL to Use

95% Student's-t UCL	571.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
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Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	11	Mean	61.27
Maximum	330	Median	30
SD	92.6	Std. Error of Mean	27.92
Coefficient of Variation	1.511	Skewness	2.914

Normal GOF Test

Shapiro Wilk Test Statistic	0.564	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.324	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	111.9	95% Adjusted-CLT UCL (Chen-1995)	133.4
		95% Modified-t UCL (Johnson-1978)	116

Gamma GOF Test

A-D Test Statistic	0.926	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.751	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.224	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.262	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.006	k star (bias corrected MLE)	0.793
Theta hat (MLE)	60.88	Theta star (bias corrected MLE)	77.31
nu hat (MLE)	22.14	nu star (bias corrected)	17.44
MLE Mean (bias corrected)	61.27	MLE Sd (bias corrected)	68.82
		Approximate Chi Square Value (0.05)	8.985
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	8.014

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	118.9	95% Adjusted Gamma UCL (use when n<50)	133.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.901	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.398	Mean of logged Data	3.542
Maximum of Logged Data	5.799	SD of logged Data	0.987

Assuming Lognormal Distribution

95% H-UCL	142.3	90% Chebyshev (MVUE) UCL	103.1
95% Chebyshev (MVUE) UCL	125.8	97.5% Chebyshev (MVUE) UCL	157.3
99% Chebyshev (MVUE) UCL	219.2		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	107.2	95% Jackknife UCL	111.9
95% Standard Bootstrap UCL	105	95% Bootstrap-t UCL	284.3
95% Hall's Bootstrap UCL	281.2	95% Percentile Bootstrap UCL	112
95% BCA Bootstrap UCL	142.8		
90% Chebyshev(Mean, Sd) UCL	145	95% Chebyshev(Mean, Sd) UCL	183
97.5% Chebyshev(Mean, Sd) UCL	235.6	99% Chebyshev(Mean, Sd) UCL	339.1

Suggested UCL to Use

95% Adjusted Gamma UCL	133.3

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.085	Mean	0.241
Maximum	0.51	Median	0.2
SD	0.132	Std. Error of Mean	0.0398
Coefficient of Variation	0.548	Skewness	0.964

Normal GOF Test

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.198	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.313	95% Adjusted-CLT UCL (Chen-1995)	0.318
		95% Modified-t UCL (Johnson-1978)	0.315

Gamma GOF Test

A-D Test Statistic	0.209	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.733	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.138	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.257	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.921	k star (bias corrected MLE)	2.912
Theta hat (MLE)	0.0613	Theta star (bias corrected MLE)	0.0826
nu hat (MLE)	86.25	nu star (bias corrected)	64.06
MLE Mean (bias corrected)	0.241	MLE Sd (bias corrected)	0.141
		Approximate Chi Square Value (0.05)	46.65
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	44.23

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.33	95% Adjusted Gamma UCL (use when n<50)	0.348

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.984	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.108	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.465	Mean of logged Data	-1.558
Maximum of Logged Data	-0.673	SD of logged Data	0.543

Assuming Lognormal Distribution

95% H-UCL	0.358	90% Chebyshev (MVUE) UCL	0.361
95% Chebyshev (MVUE) UCL	0.416	97.5% Chebyshev (MVUE) UCL	0.492
99% Chebyshev (MVUE) UCL	0.641		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.306	95% Jackknife UCL	0.313
95% Standard Bootstrap UCL	0.304	95% Bootstrap-t UCL	0.344
95% Hall's Bootstrap UCL	0.336	95% Percentile Bootstrap UCL	0.306
95% BCA Bootstrap UCL	0.319		
90% Chebyshev(Mean, Sd) UCL	0.36	95% Chebyshev(Mean, Sd) UCL	0.414
97.5% Chebyshev(Mean, Sd) UCL	0.489	99% Chebyshev(Mean, Sd) UCL	0.636

Suggested UCL to Use

95% Student's-t UCL	0.313

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	11	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	15	Mean	24.09
Maximum	42	Median	19.5
SD	8.834	Std. Error of Mean	2.664
Coefficient of Variation	0.367	Skewness	0.889

Normal GOF Test

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	28.92	95% Adjusted-CLT UCL (Chen-1995)	29.24
		95% Modified-t UCL (Johnson-1978)	29.04

Gamma GOF Test

A-D Test Statistic	0.476	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.73	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.236	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.256	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.93	k star (bias corrected MLE)	6.555
Theta hat (MLE)	2.698	Theta star (bias corrected MLE)	3.675
nu hat (MLE)	196.5	nu star (bias corrected)	144.2
MLE Mean (bias corrected)	24.09	MLE Sd (bias corrected)	9.41
		Approximate Chi Square Value (0.05)	117.5
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	113.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	29.58	95% Adjusted Gamma UCL (use when n<50)	30.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.216	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.708	Mean of logged Data	3.125
Maximum of Logged Data	3.738	SD of logged Data	0.349

Assuming Lognormal Distribution

95% H-UCL	30.14	90% Chebyshev (MVUE) UCL	31.71
95% Chebyshev (MVUE) UCL	35.18	97.5% Chebyshev (MVUE) UCL	40
99% Chebyshev (MVUE) UCL	49.47		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	28.47	95% Jackknife UCL	28.92
95% Standard Bootstrap UCL	28.16	95% Bootstrap-t UCL	30.14
95% Hall's Bootstrap UCL	29.43	95% Percentile Bootstrap UCL	28.32
95% BCA Bootstrap UCL	28.73		
90% Chebyshev(Mean, Sd) UCL	32.08	95% Chebyshev(Mean, Sd) UCL	35.7
97.5% Chebyshev(Mean, Sd) UCL	40.72	99% Chebyshev(Mean, Sd) UCL	50.59

Suggested UCL to Use

95% Student's-t UCL	28.92

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	59	Mean	748.9
Maximum	4500	Median	280
SD	1288	Std. Error of Mean	388.3
Coefficient of Variation	1.72	Skewness	2.931

Normal GOF Test

Shapiro Wilk Test Statistic	0.564	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.356	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1453	95% Adjusted-CLT UCL (Chen-1995)	1754
		95% Modified-t UCL (Johnson-1978)	1510

Gamma GOF Test

A-D Test Statistic	0.712	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.769	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.266	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.666	k star (bias corrected MLE)	0.545
Theta hat (MLE)	1124	Theta star (bias corrected MLE)	1374
nu hat (MLE)	14.66	nu star (bias corrected)	12
MLE Mean (bias corrected)	748.9	MLE Sd (bias corrected)	1014
		Approximate Chi Square Value (0.05)	5.224
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	4.517

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1720	95% Adjusted Gamma UCL (use when n<50)	1989

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.078	Mean of logged Data	5.705
Maximum of Logged Data	8.412	SD of logged Data	1.366

Assuming Lognormal Distribution

95% H-UCL	3848	90% Chebyshev (MVUE) UCL	1552
95% Chebyshev (MVUE) UCL	1953	97.5% Chebyshev (MVUE) UCL	2510
99% Chebyshev (MVUE) UCL	3603		

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1388	95% Jackknife UCL	1453
95% Standard Bootstrap UCL	1367	95% Bootstrap-t UCL	2916
95% Hall's Bootstrap UCL	3642	95% Percentile Bootstrap UCL	1487
95% BCA Bootstrap UCL	1878		
90% Chebyshev(Mean, Sd) UCL	1914	95% Chebyshev(Mean, Sd) UCL	2441
97.5% Chebyshev(Mean, Sd) UCL	3174	99% Chebyshev(Mean, Sd) UCL	4613

Suggested UCL to Use

95% Adjusted Gamma UCL	1989

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
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Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	12	Number of Distinct Observations	12
		Number of Missing Observations	12
Number of Detects	9	Number of Non-Detects	3
Number of Distinct Detects	9	Number of Distinct Non-Detects	3
Minimum Detect	41	Minimum Non-Detect	15
Maximum Detect	1700	Maximum Non-Detect	38
Variance Detects	374853	Percent Non-Detects	25%
Mean Detects	451.4	SD Detects	612.3
Median Detects	120	CV Detects	1.356
Skewness Detects	1.443	Kurtosis Detects	0.897
Mean of Logged Detects	5.181	SD of Logged Detects	1.462

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.732	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.344	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	342.3	KM Standard Error of Mean	163.6
KM SD	534.4	95% KM (BCA) UCL	655.4
95% KM (t) UCL	636.2	95% KM (Percentile Bootstrap) UCL	597.8
95% KM (z) UCL	611.4	95% KM Bootstrap t UCL	1053
90% KM Chebyshev UCL	833.2	95% KM Chebyshev UCL	1056
97.5% KM Chebyshev UCL	1364	99% KM Chebyshev UCL	1970

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.78	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.759	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.263	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.291	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.655	k star (bias corrected MLE)	0.511
Theta hat (MLE)	689.2	Theta star (bias corrected MLE)	883.9
nu hat (MLE)	11.79	nu star (bias corrected)	9.192
Mean (detects)	451.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	338.5
Maximum	1700	Median	55
SD	560.6	CV	1.656
k hat (MLE)	0.233	k star (bias corrected MLE)	0.23
Theta hat (MLE)	1456	Theta star (bias corrected MLE)	1472
nu hat (MLE)	5.581	nu star (bias corrected)	5.519
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (5.52, α)	1.399	Adjusted Chi Square Value (5.52, β)	1.11
95% Gamma Approximate UCL (use when n>=50)	1335	95% Gamma Adjusted UCL (use when n<50)	1684

Table B.15.2

Summary of ProUCL Output for EU017 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:03:13 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB 1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	342.3	SD (KM)	534.4
Variance (KM)	285609	SE of Mean (KM)	163.6
k hat (KM)	0.41	k star (KM)	0.363
nu hat (KM)	9.845	nu star (KM)	8.717
theta hat (KM)	834.4	theta star (KM)	942.4
80% gamma percentile (KM)	545.3	90% gamma percentile (KM)	982.7
95% gamma percentile (KM)	1470	99% gamma percentile (KM)	2708

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.72, α)	3.157	Adjusted Chi Square Value (8.72, β)	2.668
95% Gamma Approximate KM-UCL (use when n>=50)	945.1	95% Gamma Adjusted KM-UCL (use when n<50)	1118

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.853	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.226	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	339.9	Mean in Log Scale	4.31
SD in Original Scale	559.7	SD in Log Scale	2.009
95% t UCL (assumes normality of ROS data)	630.1	95% Percentile Bootstrap UCL	622.5
95% BCA Bootstrap UCL	696.2	95% Bootstrap t UCL	1067
95% H-UCL (Log ROS)	11444		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.563	KM Geo Mean	95.84
KM SD (logged)	1.604	95% Critical H Value (KM-Log)	4.112
KM Standard Error of Mean (logged)	0.491	95% H-UCL (KM -Log)	2533
KM SD (logged)	1.604	95% Critical H Value (KM-Log)	4.112
KM Standard Error of Mean (logged)	0.491		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	341.9	Mean in Log Scale	4.516
SD in Original Scale	558.5	SD in Log Scale	1.744
95% t UCL (Assumes normality)	631.4	95% H-Stat UCL	4258

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	1053	Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	1118

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.3

Summary of ProUCL Input Data for EU17 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum	D_Aluminum	Antimony	D_Antimony
on-site (EU17)	5 ft BGS	S05(OEPA)	7/9/1996	380	0	380	0	380	0	380	0	380	0	380	0				
on-site (EU17)	5- ft BGS	S05(OEPA)	7/9/1996													9920	1	3.5	1
on-site (EU17)	0-2 ft BGS	SS-1	11/9/2017	280	1	270	1	370	1	30	0	54	1	180	1	4700	1	0.63	1
on-site (EU17)	0.2-2.2 ft BGS	SS-2	11/9/2017	140	1	120	1	180	1	37	0	0.9	0	68	1	6300	1	2	1
on-site (EU17)	0.3-2.3 ft BGS	SS-3	11/9/2017	600	1	465	1	770	1	132	0	54	1	325	1	5100	1	4.25	1
on-site (EU17)	0-2 ft BGS	SS-4	12/20/2018	170	1	210	1	300	1	24	0	39	1	160	1	6500	1	0.2	1
on-site (EU17)	0.33-2.33 ft BGS	SS-5	12/20/2018	970	1	875	1	1340	1	80.5	1	124	1	370	1	6250	1	7.25	1
on-site (EU17)	0.33-2.33 ft BGS	SS-6	12/20/2018	230	1	310	1	440	1	71	0	60	1	220	1	14000	1	260	1
on-site (EU17)	0-2 ft BGS	SS-7	12/20/2018	950	1	1000	1	1600	1	70	1	130	1	450	1	4600	1	80	1
on-site (EU17)	0-2 ft BGS	SS-8	12/20/2018	540	1	600	1	960	1	67	1	140	1	450	1	11000	1	3.2	1
on-site (EU17)	0-2 ft BGS	SS-9	12/20/2018	99	1	96	1	170	1	23	0	27	1	65	1	10000	1	15	1
on-site (EU17)	0-2 ft BGS	SS-10	12/20/2018	24	1	24	1	37	1	23	0	8.3	0	15	1	12000	1	8.3	1
on-site (EU17)	0-2 ft BGS	SS-11	12/20/2018	93	1	110	1	200	1	21	0	7.8	0	47	1	5500	1	0.85	1
on-site (EU17)	0-2 ft BGS	SS-95	12/20/2018																
on-site (EU17)	0-2 ft BGS	SS-96	12/20/2018																
on-site (EU17)	0.33-2.33 ft BGS	SS-97	12/20/2018																
on-site (EU17)	0-2 ft BGS	SS-127	12/20/2018																
on-site (EU17)	0-2 ft BGS	SS-128	12/20/2018																
on-site (EU17)	0-2 ft BGS	SS-129	12/20/2018																
on-site (EU17)	0-0.5 ft BGS	SS-174-AS	12/20/2018																
on-site (EU17)	0-0.5 ft BGS	SS-175-AS	11/27/2018																
on-site (EU17)	0.33-0.83 ft BGS	SS-176-AS	11/27/2018																
on-site (EU17)	0-0.5 ft BGS	SS-177-AS	12/20/2018																
on-site (EU17)	0-0.5 ft BGS	SS-178-AS	12/20/2018																
on-site (EU17)	14-15 ft BGS	TP-8	11/9/2017	31	1	29	1	37	1	31	0	0.77	0	18	1	5200	1	0.31	0
on-site (EU17)	4-6 ft BGS	TP-8	11/9/2017																
on-site (EU17)	0-2 ft BGS	TP-9	11/9/2017																
on-site (EU17)	2-4 ft BGS	TP-9	11/9/2017	2000	1	1000	1	2100	1	420	1	3.9	0	810	1	4700	1	7.1	1
on-site (EU17)	4-6 ft BGS	TP-10	11/9/2017	370	1	310	1	560	1	47	1	68	1	220	1	7000	1	9.2	1
on-site (EU17)	8-10 ft BGS	TP-10	11/9/2017																
on-site (EU17)	15 ft BGS	TT-1	9/26/2008	6.9	0	6.9	0			52	0	6.9	0	6.9	0				
on-site (EU17)	15- ft BGS	TT-1	9/26/2008					7.1	1							2920	1	12.8	1
on-site (EU17)	8 ft BGS	TT-1	9/26/2008							54	0	7.2	0	7.2	0				
on-site (EU17)	8- ft BGS	TT-1	9/26/2008	15	1	15	1	21	1							9680	1	1	1
on-site (EU17)	13.5 ft BGS	TT-2	9/26/2008							54	0	7.2	0						
on-site (EU17)	13.5- ft BGS	TT-2	9/26/2008	22	1	22	1	28	1					14	1	6660	1	1.6	1
on-site (EU17)	9 ft BGS	TT-2	9/26/2008							56	0	7.5	0	7.5	0				
on-site (EU17)	9- ft BGS	TT-2	9/26/2008	18	1	16	1	20	1							8230	1	0.51	1
on-site (EU17)	10 ft BGS	TT-3	9/29/2008							54	0								
on-site (EU17)	10- ft BGS	TT-3	9/29/2008	85	1	88	1	140	1			15	1	54	1	4190	1	1.5	1
on-site (EU17)	5 ft BGS	TT-3	9/29/2008	30	0	30	0			220	0	30	0	30	0				
on-site (EU17)	5- ft BGS	TT-3	9/29/2008					36	1							5080	1	4	1
on-site (EU17)	12 ft BGS	TT-4	9/29/2008							56	0	7.5	0						
on-site (EU17)	12- ft BGS	TT-4	9/29/2008	27	1	23	1	61	1					24	1	7310	1	1.8	1
on-site (EU17)	3 ft BGS	TT-4	9/29/2008							210	1								
on-site (EU17)	3- ft BGS	TT-4	9/29/2008	1700	1	800	1	2900	1			260	1	800	1	6760	1	199	1
on-site (EU17)	5 ft BGS	TT-4	9/29/2008																
on-site (EU17)	5- ft BGS	TT-4	9/29/2008	790	1	540	1	730	1	260	1	68	1	270	1	4300	1	8.2	1
on-site (EU17)	9 ft BGS	TT-4	9/29/2008							52	0	7	0	7	0				
on-site (EU17)	9- ft BGS	TT-4	9/29/2008	8	1	7.4	1	12	1							3330	1	1.1	1
on-site (EU17)	14 ft BGS	TT-5	9/30/2008																
on-site (EU17)	14- ft BGS	TT-5	9/30/2008	6700	1	4400	1	5900	1	1600	1	595	1	2000	1	5550	1	20.1	1
on-site (EU17)	3 ft BGS	TT-5	9/30/2008							530	0								
on-site (EU17)	3- ft BGS	TT-5	9/30/2008	6300	1	6000	1	8700	1			1200	1	3500	1	2640	1	29.1	1
on-site (EU17)	7 ft BGS	TT-5	9/30/2008							1300	0	180	0						
on-site (EU17)	7- ft BGS	TT-5	9/30/2008	280	1	270	1	390	1					220	1	9700	1	669	1
on-site (EU17)	7 ft BGS	TT-19	10/7/2008							53	0	7.1	0						
on-site (EU17)	7 ft BGS	TT-19	10/7/2008	48	1	58	1	78	1					37	1	7420	1	5.2	1
on-site (EU17)	9 ft BGS	TT-19	10/7/2008							53	0	7	0	7	0			6.3	0
on-site (EU17)	9 ft BGS	TT-19	10/7/2008	21	1	18	1	20	1							2720	1		
on-site (EU17)	15 ft BGS	TT-20	10/7/2008							60	0	8	0					7.2	0
on-site (EU17)	15 ft BGS	TT-20	10/7/2008	57	1	51	1	59	1					27	1	4960	1		
on-site (EU17)	7 ft BGS	TT-20	10/7/2008																
on-site (EU17)	7 ft BGS	TT-20	10/7/2008	730	1	660	1	950	1	69	1	130	1	390	1	14800	1	17.9	1
on-site (EU17)	-	TT-20	10/8/2008																

Table B.15.3

Summary of ProUCL Input Data for EU17 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Lead - coarse fraction	D_Lead - coarse fraction
on-site (EU17)	5 ft BGS	S05(OEPA)	7/9/1996					0.23	0							0.17	0						
on-site (EU17)	5- ft BGS	S05(OEPA)	7/9/1996	12.2	1	268	1			1.8	1	7.9	1	18.3	1			19200	1	16.8	1		
on-site (EU17)	0-2 ft BGS	SS-1	11/9/2017	7.3	1	87	1	0.37	1	1.3	1	4.2	1	24	1	0.5	0	11000	1	58	1	65	1
on-site (EU17)	0.2-2.2 ft BGS	SS-2	11/9/2017	25	1	380	1	4	1	3.9	1	12	1	1600	1	0.63	0	10000	1	190	1		
on-site (EU17)	0.3-2.3 ft BGS	SS-3	11/9/2017	14	1	610	1	2.895	1	3.65	1	13.5	1	264.5	1	13	1	21150	1	430	1	690	1
on-site (EU17)	0-2 ft BGS	SS-4	12/20/2018	6.2	1	130	1	0.54	1	0.31	1	5.2	1	40	1			14000	1	51	1		
on-site (EU17)	0.33-2.33 ft BGS	SS-5	12/20/2018	16.5	1	505	1	10.2	1	0.72	1	38	1	685	1	6.8	1	36000	1	305	1		
on-site (EU17)	0.33-2.33 ft BGS	SS-6	12/20/2018	29	1	1300	1	20	1	1.8	0	23	1	6000	1	0.88	1	30000	1	2400	1	4500	1
on-site (EU17)	0-2 ft BGS	SS-7	12/20/2018	8.7	1	470	1	6.6	1	2.8	0	6.9	1	930	1	0.49	1	19000	1	930	1		
on-site (EU17)	0-2 ft BGS	SS-8	12/20/2018	16	1	330	1	3	1	3.3	0	9.9	1	310	1	0.29	1	21000	1	450	1	320	1
on-site (EU17)	0-2 ft BGS	SS-9	12/20/2018	16	1	400	1	0.81	1	1.4	0	6.7	1	53	1			18000	1	60	1		
on-site (EU17)	0-2 ft BGS	SS-10	12/20/2018	13	1	1800	1	0.24	1	1.4	0	7.9	1	19	1			20000	1	20	1	20	1
on-site (EU17)	0-2 ft BGS	SS-11	12/20/2018	8.2	1	86	1	0.48	1	1.4	0	5.3	1	25	1			14000	1	68	1		
on-site (EU17)	0-2 ft BGS	SS-95	12/20/2018																				
on-site (EU17)	0-2 ft BGS	SS-96	12/20/2018																				
on-site (EU17)	0.33-2.33 ft BGS	SS-97	12/20/2018																				
on-site (EU17)	0-2 ft BGS	SS-127	12/20/2018																				
on-site (EU17)	0-2 ft BGS	SS-128	12/20/2018																				
on-site (EU17)	0-2 ft BGS	SS-129	12/20/2018																				
on-site (EU17)	0-0.5 ft BGS	SS-174-AS	12/20/2018																				
on-site (EU17)	0-0.5 ft BGS	SS-175-AS	11/27/2018																				
on-site (EU17)	0.33-0.83 ft BGS	SS-176-AS	11/27/2018																				
on-site (EU17)	0-0.5 ft BGS	SS-177-AS	12/20/2018																				
on-site (EU17)	0-0.5 ft BGS	SS-178-AS	12/20/2018																				
on-site (EU17)	14-15 ft BGS	TP-8	11/9/2017	5.9	1	67	1	0.22	1	1.2	1	4.1	1	8.1	1	0.5	0	12000	1	7.8	1		
on-site (EU17)	4-6 ft BGS	TP-8	11/9/2017																				
on-site (EU17)	0-2 ft BGS	TP-9	11/9/2017																				
on-site (EU17)	2-4 ft BGS	TP-9	11/9/2017	9.5	1	150	1	1.7	1	1.4	1	4.9	1	7100	1	0.53	0	9900	1	130	1		
on-site (EU17)	4-6 ft BGS	TP-10	11/9/2017	19	1	1600	1	8.8	1	8.9	1	38	1	870	1	0.64	0	24000	1	1100	1		
on-site (EU17)	8-10 ft BGS	TP-10	11/9/2017																				
on-site (EU17)	15 ft BGS	TT-1	9/26/2008													0.52	0						
on-site (EU17)	15- ft BGS	TT-1	9/26/2008	14.1	1	342	1	0.14	1	0.8	1	2.1	1	19.1	1			6340	1	5.4	1		
on-site (EU17)	8 ft BGS	TT-1	9/26/2008													0.54	0						
on-site (EU17)	8- ft BGS	TT-1	9/26/2008	8.4	1	148	1	0.26	1	1.8	1	5.2	1	14.2	1			15600	1	12.9	1		
on-site (EU17)	13.5 ft BGS	TT-2	9/26/2008													0.54	0						
on-site (EU17)	13.5- ft BGS	TT-2	9/26/2008	7.3	1	84.2	1	0.31	1	1.6	1	4.6	1	15.4	1			14300	1	11.4	1		
on-site (EU17)	9 ft BGS	TT-2	9/26/2008													0.56	0						
on-site (EU17)	9- ft BGS	TT-2	9/26/2008	5.1	1	61.5	1	0.27	1	1.9	1	6.9	1	13.8	1			15300	1	15.3	1		
on-site (EU17)	10 ft BGS	TT-3	9/29/2008																				
on-site (EU17)	10- ft BGS	TT-3	9/29/2008	11.9	1	224	1	15.1	1	2.8	1	4.8	1	181	1	0.37	1	10500	1	426	1		
on-site (EU17)	5 ft BGS	TT-3	9/29/2008																				
on-site (EU17)	5- ft BGS	TT-3	9/29/2008	22.7	1	535	1	1.6	1	1.6	1	8.1	1	186	1	0.46	1	8230	1	116	1		
on-site (EU17)	12 ft BGS	TT-4	9/29/2008													0.56	0						
on-site (EU17)	12- ft BGS	TT-4	9/29/2008	8.3	1	124	1	0.43	1	1.6	1	5.7	1	34.6	1			15700	1	32.8	1		
on-site (EU17)	3 ft BGS	TT-4	9/29/2008																				
on-site (EU17)	3- ft BGS	TT-4	9/29/2008	57.3	1	1030	1	30.5	1	10.6	1	14.7	1	43400	1	0.9	1	82400	1	3970	1		
on-site (EU17)	5 ft BGS	TT-4	9/29/2008																				
on-site (EU17)	5- ft BGS	TT-4	9/29/2008	17.3	1	139	1	1.4	1	1.8	1	4.8	1	69.1	1	2.1	1	8180	1	72.1	1		
on-site (EU17)	9 ft BGS	TT-4	9/29/2008													0.52	0						
on-site (EU17)	9- ft BGS	TT-4	9/29/2008	5.5	1	47.9	1	0.21	1	1.1	1	3.6	1	49.8	1			10100	1	17	1		
on-site (EU17)	14 ft BGS	TT-5	9/30/2008													0.555	0						
on-site (EU17)	14- ft BGS	TT-5	9/30/2008	28.4	1	265	1	2.08	1	2.8	1	10.95	1	192	1			9985	1	130.15	1		
on-site (EU17)	3 ft BGS	TT-5	9/30/2008																				
on-site (EU17)	3- ft BGS	TT-5	9/30/2008	8.6	1	159	1	2.6	1	2.9	1	4.7	1	2360	1	0.31	1	14300	1	484	1		
on-site (EU17)	7 ft BGS	TT-5	9/30/2008																				
on-site (EU17)	7- ft BGS	TT-5	9/30/2008	29.7	1	423	1	34.2	1	19.7	1	22.5	1	10400	1	0.79	1	121000	1	14100	1		
on-site (EU17)	7 ft BGS	TT-19	10/7/2008																				
on-site (EU17)	7 ft BGS	TT-19	10/7/2008	7.6	1	1310	1	46.1	1	13.4	1	16.9	1	947	1	4.1	1	27700	1	971	1		
on-site (EU17)	9 ft BGS	TT-19	10/7/2008							0.86	1					0.53	0						
on-site (EU17)	9 ft BGS	TT-19	10/7/2008	4	1	29.5	1	0.39	1			2.5	1	93.6	1			8770	1	10.2	1		
on-site (EU17)	15 ft BGS	TT-20	10/7/2008													0.6	0						
on-site (EU17)	15 ft BGS	TT-20	10/7/2008	5.1	1	94.1	1	0.33	1	1.1	1	3.8	1	23.2	1			11300	1	8	1		
on-site (EU17)	7 ft BGS	TT-20	10/7/2008																				
on-site (EU17)	7 ft BGS	TT-20	10/7/2008	29.3	1	4370	1	39.1	1	13.3	1	28.9	1	1000	1	0.83	1	135000	1	3480	1		
on-site (EU17)	-	TT-20	10/8/2008																				

Table B.15.3

Summary of ProUCL Input Data for EU17 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				36	37	38	39	40	41	42	43	44	45	46	47
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel	Thallium	D_Thallium
on-site (EU17)	5 ft BGS	S05(OEPA)	7/9/1996							0.12	0				
on-site (EU17)	5- ft BGS	S05(OEPA)	7/9/1996					621	1			15.1	1	2.4	1
on-site (EU17)	0-2 ft BGS	SS-1	11/9/2017	110	1	73	1	350	1	0.068	1	11	1	0.16	1
on-site (EU17)	0.2-2.2 ft BGS	SS-2	11/9/2017					140	1	0.18	1	30	1	0.51	1
on-site (EU17)	0.3-2.3 ft BGS	SS-3	11/9/2017	920	1	740	1	510	1	0.265	1	33.5	1	0.335	1
on-site (EU17)	0-2 ft BGS	SS-4	12/20/2018					430	1	0.06	1	15	1	0.2	1
on-site (EU17)	0.33-2.33 ft BGS	SS-5	12/20/2018					500	1	0.072	1	96.5	1	0.1455	1
on-site (EU17)	0.33-2.33 ft BGS	SS-6	12/20/2018	2500	1	4100	1	760	1	0.24	1	330	1	0.41	1
on-site (EU17)	0-2 ft BGS	SS-7	12/20/2018					330	1	0.068	1	60	1	0.17	1
on-site (EU17)	0-2 ft BGS	SS-8	12/20/2018	300	1	320	1	540	1	0.23	1	43	1	0.22	1
on-site (EU17)	0-2 ft BGS	SS-9	12/20/2018					530	1	0.081	1	19	1	0.12	1
on-site (EU17)	0-2 ft BGS	SS-10	12/20/2018	47	1	22	1	760	1	0.052	1	19	1	0.085	1
on-site (EU17)	0-2 ft BGS	SS-11	12/20/2018					320	1	0.15	1	17	1	0.29	1
on-site (EU17)	0-2 ft BGS	SS-95	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-96	12/20/2018												
on-site (EU17)	0.33-2.33 ft BGS	SS-97	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-127	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-128	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-129	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-174-AS	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-175-AS	11/27/2018												
on-site (EU17)	0.33-0.83 ft BGS	SS-176-AS	11/27/2018												
on-site (EU17)	0-0.5 ft BGS	SS-177-AS	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-178-AS	12/20/2018												
on-site (EU17)	14-15 ft BGS	TP-8	11/9/2017					420	1	0.02	0	9.6	1	0.14	1
on-site (EU17)	4-6 ft BGS	TP-8	11/9/2017												
on-site (EU17)	0-2 ft BGS	TP-9	11/9/2017												
on-site (EU17)	2-4 ft BGS	TP-9	11/9/2017					330	1	0.053	1	29	1	0.19	1
on-site (EU17)	4-6 ft BGS	TP-10	11/9/2017					550	1	0.44	1	94	1	0.35	1
on-site (EU17)	8-10 ft BGS	TP-10	11/9/2017												
on-site (EU17)	15 ft BGS	TT-1	9/26/2008											0.1	0
on-site (EU17)	15- ft BGS	TT-1	9/26/2008					241	1	0.33	1	6.4	1		
on-site (EU17)	8 ft BGS	TT-1	9/26/2008												
on-site (EU17)	8- ft BGS	TT-1	9/26/2008					489	1	0.021	1	12.9	1	0.13	1
on-site (EU17)	13.5 ft BGS	TT-2	9/26/2008												
on-site (EU17)	13.5- ft BGS	TT-2	9/26/2008					416	1	0.016	1	11.8	1	0.12	1
on-site (EU17)	9 ft BGS	TT-2	9/26/2008											0.11	0
on-site (EU17)	9- ft BGS	TT-2	9/26/2008					437	1	0.043	1	16.3	1		
on-site (EU17)	10 ft BGS	TT-3	9/29/2008												
on-site (EU17)	10- ft BGS	TT-3	9/29/2008					184	1	0.17	1	19.1	1	0.29	1
on-site (EU17)	5 ft BGS	TT-3	9/29/2008												
on-site (EU17)	5- ft BGS	TT-3	9/29/2008					80.3	1	0.16	1	17.9	1	0.63	1
on-site (EU17)	12 ft BGS	TT-4	9/29/2008											0.2	0
on-site (EU17)	12- ft BGS	TT-4	9/29/2008					609	1	0.052	1	16.4	1		
on-site (EU17)	3 ft BGS	TT-4	9/29/2008											5.6	0
on-site (EU17)	3- ft BGS	TT-4	9/29/2008					533	1	0.84	1	129	1		
on-site (EU17)	5 ft BGS	TT-4	9/29/2008												
on-site (EU17)	5- ft BGS	TT-4	9/29/2008					165	1	0.089	1	13.6	1	0.41	1
on-site (EU17)	9 ft BGS	TT-4	9/29/2008												
on-site (EU17)	9- ft BGS	TT-4	9/29/2008					252	1	0.017	1	9.7	1	0.11	0
on-site (EU17)	14 ft BGS	TT-5	9/30/2008												
on-site (EU17)	14- ft BGS	TT-5	9/30/2008					189.5	1	0.185	1	35.2	1	1.4	1
on-site (EU17)	3 ft BGS	TT-5	9/30/2008											0.13	0
on-site (EU17)	3- ft BGS	TT-5	9/30/2008					220	1	0.49	1	56.8	1		
on-site (EU17)	7 ft BGS	TT-5	9/30/2008											26.4	0
on-site (EU17)	7- ft BGS	TT-5	9/30/2008					1490	1	0.69	1	475	1		
on-site (EU17)	7 ft BGS	TT-19	10/7/2008					479	1						
on-site (EU17)	7 ft BGS	TT-19	10/7/2008							0.088	1	34.4	1	0.17	1
on-site (EU17)	9 ft BGS	TT-19	10/7/2008					183	1	0.11	0			0.13	0
on-site (EU17)	9 ft BGS	TT-19	10/7/2008									8	1		
on-site (EU17)	15 ft BGS	TT-20	10/7/2008					386	1					0.12	0
on-site (EU17)	15 ft BGS	TT-20	10/7/2008							0.022	1	9.2	1		
on-site (EU17)	7 ft BGS	TT-20	10/7/2008											0.13	0
on-site (EU17)	7 ft BGS	TT-20	10/7/2008					997	1	2.2	1	377	1		
on-site (EU17)	-	TT-20	10/8/2008												

Table B.15.3

Summary of ProUCL Input Data for EU17 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				48	49	50	51	52	53	54	55	56	57	58	59
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Vanadium	D_Vanadium	Zinc	D_Zinc	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Aroclor-1260 (PCB-1260)	D_Aroclor-1260 (PCB-1260)	Dieldrin	D_Dieldrin
on-site (EU17)	5 ft BGS	S05(OEPA)	7/9/1996					38	0	38	0	38	0	3.8	0
on-site (EU17)	5- ft BGS	S05(OEPA)	7/9/1996	24	1	60.9	1								
on-site (EU17)	0-2 ft BGS	SS-1	11/9/2017	15	1	90	1	19	0	15	0	20	0	1	0
on-site (EU17)	0.2-2.2 ft BGS	SS-2	11/9/2017	35	1	920	1	23	0	120	1	24	0	1.2	0
on-site (EU17)	0.3-2.3 ft BGS	SS-3	11/9/2017	19.5	1	845	1	21.5	0	51.5	1	22.5	0	6.05	0
on-site (EU17)	0-2 ft BGS	SS-4	12/20/2018	16	1	110	1	29	0	57	1	27	0	1.4	0
on-site (EU17)	0.33-2.33 ft BGS	SS-5	12/20/2018	19.5	1	465	1	27	0	670	1	25	0	12	1
on-site (EU17)	0.33-2.33 ft BGS	SS-6	12/20/2018	42	1	4500	1	71	0	1200	1	65	0	11	1
on-site (EU17)	0-2 ft BGS	SS-7	12/20/2018	16	1	780	1	28	0	170	1	25	0	7.2	1
on-site (EU17)	0-2 ft BGS	SS-8	12/20/2018	28	1	280	1	63	0	1700	1	58	0	7.7	0
on-site (EU17)	0-2 ft BGS	SS-9	12/20/2018	27	1	110	1	27	0	53	1	25	0	1.3	0
on-site (EU17)	0-2 ft BGS	SS-10	12/20/2018	29	1	59	1	28	0	27	0	25	0	1.3	0
on-site (EU17)	0-2 ft BGS	SS-11	12/20/2018	18	1	79	1	26	0	41	1	24	0	1.2	0
on-site (EU17)	0-2 ft BGS	SS-95	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-96	12/20/2018												
on-site (EU17)	0.33-2.33 ft BGS	SS-97	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-127	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-128	12/20/2018												
on-site (EU17)	0-2 ft BGS	SS-129	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-174-AS	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-175-AS	11/27/2018												
on-site (EU17)	0.33-0.83 ft BGS	SS-176-AS	11/27/2018												
on-site (EU17)	0-0.5 ft BGS	SS-177-AS	12/20/2018												
on-site (EU17)	0-0.5 ft BGS	SS-178-AS	12/20/2018												
on-site (EU17)	14-15 ft BGS	TP-8	11/9/2017	15	1	35	1	19	0	16	0	20	0	1.1	0
on-site (EU17)	4-6 ft BGS	TP-8	11/9/2017												
on-site (EU17)	0-2 ft BGS	TP-9	11/9/2017												
on-site (EU17)	2-4 ft BGS	TP-9	11/9/2017	16	1	520	1	19	0	41	1	20	0	2.1	0
on-site (EU17)	4-6 ft BGS	TP-10	11/9/2017	31	1	2000	1	24	0	20	0	34	1	1.3	0
on-site (EU17)	8-10 ft BGS	TP-10	11/9/2017												
on-site (EU17)	15 ft BGS	TT-1	9/26/2008					34	0	34	0	34	0	18	0
on-site (EU17)	15- ft BGS	TT-1	9/26/2008	8.6	1	23	1								
on-site (EU17)	8 ft BGS	TT-1	9/26/2008					36	0	36	0	36	0	18	0
on-site (EU17)	8- ft BGS	TT-1	9/26/2008	22.8	1	54.2	1								
on-site (EU17)	13.5 ft BGS	TT-2	9/26/2008					35	0	35	0	35	0	9.1	0
on-site (EU17)	13.5- ft BGS	TT-2	9/26/2008	18.7	1	48.1	1								
on-site (EU17)	9 ft BGS	TT-2	9/26/2008					37	0	37	0	37	0	9.6	0
on-site (EU17)	9- ft BGS	TT-2	9/26/2008	23.1	1	54.8	1								
on-site (EU17)	10 ft BGS	TT-3	9/29/2008					36	0	36	0			92	0
on-site (EU17)	10- ft BGS	TT-3	9/29/2008	15.2	1	230	1					230	1		
on-site (EU17)	5 ft BGS	TT-3	9/29/2008					36	0	36	0			20	1
on-site (EU17)	5- ft BGS	TT-3	9/29/2008	28.2	1	165	1					280	1		
on-site (EU17)	12 ft BGS	TT-4	9/29/2008					37	0	37	0	23	1	38	0
on-site (EU17)	12- ft BGS	TT-4	9/29/2008	18.8	1	67.6	1								
on-site (EU17)	3 ft BGS	TT-4	9/29/2008					37	0	37	0			65	1
on-site (EU17)	3- ft BGS	TT-4	9/29/2008	35.7	1	3070	1					520	1		
on-site (EU17)	5 ft BGS	TT-4	9/29/2008					35	0			35	0	91	0
on-site (EU17)	5- ft BGS	TT-4	9/29/2008	17.2	1	115	1			52	1				
on-site (EU17)	9 ft BGS	TT-4	9/29/2008					34	0	34	0	34	0	18	0
on-site (EU17)	9- ft BGS	TT-4	9/29/2008	12.8	1	38.6	1								
on-site (EU17)	14 ft BGS	TT-5	9/30/2008					36.5	0			365.5	0	142	0
on-site (EU17)	14- ft BGS	TT-5	9/30/2008	27.35	1	302.5	1			165	1				
on-site (EU17)	3 ft BGS	TT-5	9/30/2008					35	0			35	0	180	0
on-site (EU17)	3- ft BGS	TT-5	9/30/2008	12.1	1	640	1			230	1				
on-site (EU17)	7 ft BGS	TT-5	9/30/2008					44	0			44	0	110	0
on-site (EU17)	7- ft BGS	TT-5	9/30/2008	51.8	1	21900	1			510	1				
on-site (EU17)	7 ft BGS	TT-19	10/7/2008							1800	0	1300	1	31	1
on-site (EU17)	7 ft BGS	TT-19	10/7/2008	20.1	1	922	1	8100	1						
on-site (EU17)	9 ft BGS	TT-19	10/7/2008					56	0	35	0	35	0	1.8	0
on-site (EU17)	9 ft BGS	TT-19	10/7/2008	10.1	1	42.7	1								
on-site (EU17)	15 ft BGS	TT-20	10/7/2008					39	0	39	0	39	0	10	0
on-site (EU17)	15 ft BGS	TT-20	10/7/2008	12.8	1	35.8	1								
on-site (EU17)	7 ft BGS	TT-20	10/7/2008					43	0			43	0	45	0
on-site (EU17)	7 ft BGS	TT-20	10/7/2008	21.7	1	6970	1			130	1				
on-site (EU17)	-	TT-20	10/8/2008					38	0	38	0	38	0		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	32	Number of Distinct Observations	31
		Number of Missing Observations	32
Number of Detects	29	Number of Non-Detects	3
Number of Distinct Detects	28	Number of Distinct Non-Detects	3
Minimum Detect	8	Minimum Non-Detect	6.9
Maximum Detect	6700	Maximum Non-Detect	380
Variance Detects	2744107	Percent Non-Detects	9.375%
Mean Detects	803.4	SD Detects	1657
Median Detects	170	CV Detects	2.062
Skewness Detects	3.094	Kurtosis Detects	9.167
Mean of Logged Detects	5.179	SD of Logged Detects	1.846

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.507	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.926	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.322	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.161	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	731.9	KM Standard Error of Mean	281.7
KM SD	1566	95% KM (BCA) UCL	1252
95% KM (t) UCL	1209	95% KM (Percentile Bootstrap) UCL	1202
95% KM (z) UCL	1195	95% KM Bootstrap t UCL	2179
90% KM Chebyshev UCL	1577	95% KM Chebyshev UCL	1960
97.5% KM Chebyshev UCL	2491	99% KM Chebyshev UCL	3535

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.129	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.827	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.144	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.174	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.431	k star (bias corrected MLE)	0.409
Theta hat (MLE)	1865	Theta star (bias corrected MLE)	1964
nu hat (MLE)	24.98	nu star (bias corrected)	23.73
Mean (detects)	803.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	728.1
Maximum	6700	Median	119.5
SD	1592	CV	2.187
k hat (MLE)	0.297	k star (bias corrected MLE)	0.29
Theta hat (MLE)	2454	Theta star (bias corrected MLE)	2513
nu hat (MLE)	18.99	nu star (bias corrected)	18.54
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (18.54, α)	9.782	Adjusted Chi Square Value (18.54, β)	9.441
95% Gamma Approximate UCL (use when n>=50)	1380	95% Gamma Adjusted UCL (use when n<50)	1430

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	731.9	SD (KM)	1566
Variance (KM)	2451021	SE of Mean (KM)	281.7
k hat (KM)	0.219	k star (KM)	0.219
nu hat (KM)	13.99	nu star (KM)	14.01
theta hat (KM)	3349	theta star (KM)	3344
80% gamma percentile (KM)	1008	90% gamma percentile (KM)	2211
95% gamma percentile (KM)	3681	99% gamma percentile (KM)	7669

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (14.01, α)	6.577	Adjusted Chi Square Value (14.01, β)	6.305
95% Gamma Approximate KM-UCL (use when n>=50)	1559	95% Gamma Adjusted KM-UCL (use when n<50)	1626

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.926	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.104	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.161	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	730.5	Mean in Log Scale	4.925
SD in Original Scale	1591	SD in Log Scale	1.981
95% t UCL (assumes normality of ROS data)	1207	95% Percentile Bootstrap UCL	1203
95% BCA Bootstrap UCL	1464	95% Bootstrap t UCL	2096
95% H-UCL (Log ROS)	3788		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.964	KM Geo Mean	143.1
KM SD (logged)	1.883	95% Critical H Value (KM-Log)	3.652
KM Standard Error of Mean (logged)	0.341	95% H-UCL (KM -Log)	2894
KM SD (logged)	1.883	95% Critical H Value (KM-Log)	3.652
KM Standard Error of Mean (logged)	0.341		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	734.6	Mean in Log Scale	4.981
SD in Original Scale	1589	SD in Log Scale	1.932
95% t UCL (Assumes normality)	1211	95% H-Stat UCL	3435

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	1626

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	32	Number of Distinct Observations	29
		Number of Missing Observations	32
Number of Detects	29	Number of Non-Detects	3
Number of Distinct Detects	26	Number of Distinct Non-Detects	3
Minimum Detect	7.4	Minimum Non-Detect	6.9
Maximum Detect	6000	Maximum Non-Detect	380
Variance Detects	1744477	Percent Non-Detects	9.375%
Mean Detects	634	SD Detects	1321
Median Detects	210	CV Detects	2.083
Skewness Detects	3.412	Kurtosis Detects	11.66
Mean of Logged Detects	5.082	SD of Logged Detects	1.76

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.489	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.926	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.322	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.161	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	578.5	KM Standard Error of Mean	224.5
KM SD	1248	95% KM (BCA) UCL	1073
95% KM (t) UCL	959.1	95% KM (Percentile Bootstrap) UCL	979.9
95% KM (z) UCL	947.7	95% KM Bootstrap t UCL	1840
90% KM Chebyshev UCL	1252	95% KM Chebyshev UCL	1557
97.5% KM Chebyshev UCL	1980	99% KM Chebyshev UCL	2812

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.024	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.819	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.139	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.173	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.468	k star (bias corrected MLE)	0.443
Theta hat (MLE)	1354	Theta star (bias corrected MLE)	1432
nu hat (MLE)	27.16	nu star (bias corrected)	25.68
Mean (detects)	634		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	574.6
Maximum	6000	Median	115
SD	1269	CV	2.209
k hat (MLE)	0.314	k star (bias corrected MLE)	0.305
Theta hat (MLE)	1830	Theta star (bias corrected MLE)	1882
nu hat (MLE)	20.09	nu star (bias corrected)	19.54
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (19.54, α)	10.51	Adjusted Chi Square Value (19.54, β)	10.16
95% Gamma Approximate UCL (use when n>=50)	1068	95% Gamma Adjusted UCL (use when n<50)	1105

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	578.5	SD (KM)	1248
Variance (KM)	1556784	SE of Mean (KM)	224.5
k hat (KM)	0.215	k star (KM)	0.216
nu hat (KM)	13.76	nu star (KM)	13.8
theta hat (KM)	2691	theta star (KM)	2683
80% gamma percentile (KM)	791	90% gamma percentile (KM)	1748
95% gamma percentile (KM)	2921	99% gamma percentile (KM)	6112

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.80, α)	6.435	Adjusted Chi Square Value (13.80, β)	6.166
95% Gamma Approximate KM-UCL (use when n>=50)	1241	95% Gamma Adjusted KM-UCL (use when n<50)	1295

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.926	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.111	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.161	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	577	Mean in Log Scale	4.845
SD in Original Scale	1268	SD in Log Scale	1.882
95% t UCL (assumes normality of ROS data)	957.1	95% Percentile Bootstrap UCL	977.9
95% BCA Bootstrap UCL	1130	95% Bootstrap t UCL	1891
95% H-UCL (Log ROS)	2567		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.875	KM Geo Mean	131
KM SD (logged)	1.799	95% Critical H Value (KM-Log)	3.527
KM Standard Error of Mean (logged)	0.327	95% H-UCL (KM -Log)	2067
KM SD (logged)	1.799	95% Critical H Value (KM-Log)	3.527
KM Standard Error of Mean (logged)	0.327		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	581.1	Mean in Log Scale	4.893
SD in Original Scale	1267	SD in Log Scale	1.849
95% t UCL (Assumes normality)	960.8	95% H-Stat UCL	2436

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	1295

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	32	Number of Distinct Observations	30
		Number of Missing Observations	32
Number of Detects	31	Number of Non-Detects	1
Number of Distinct Detects	29	Number of Distinct Non-Detects	1
Minimum Detect	7.1	Minimum Non-Detect	380
Maximum Detect	8700	Maximum Non-Detect	380
Variance Detects	3476848	Percent Non-Detects	3.125%
Mean Detects	939.2	SD Detects	1865
Median Detects	200	CV Detects	1.985
Skewness Detects	3.229	Kurtosis Detects	11.03
Mean of Logged Detects	5.343	SD of Logged Detects	1.902

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.542	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.309	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.156	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	913	KM Standard Error of Mean	325.5
KM SD	1811	95% KM (BCA) UCL	1467
95% KM (t) UCL	1465	95% KM (Percentile Bootstrap) UCL	1503
95% KM (z) UCL	1448	95% KM Bootstrap t UCL	2365
90% KM Chebyshev UCL	1890	95% KM Chebyshev UCL	2332
97.5% KM Chebyshev UCL	2946	99% KM Chebyshev UCL	4152

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.895	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.825	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.125	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.168	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.433	k star (bias corrected MLE)	0.412
Theta hat (MLE)	2170	Theta star (bias corrected MLE)	2278
nu hat (MLE)	26.83	nu star (bias corrected)	25.57
Mean (detects)	939.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	909.9
Maximum	8700	Median	190
SD	1842	CV	2.024
k hat (MLE)	0.374	k star (bias corrected MLE)	0.359
Theta hat (MLE)	2435	Theta star (bias corrected MLE)	2531
nu hat (MLE)	23.91	nu star (bias corrected)	23
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (23.00, α)	13.09	Adjusted Chi Square Value (23.00, β)	12.69
95% Gamma Approximate UCL (use when n>=50)	1599	95% Gamma Adjusted UCL (use when n<50)	1649

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	913	SD (KM)	1811
Variance (KM)	3281268	SE of Mean (KM)	325.5
k hat (KM)	0.254	k star (KM)	0.251
nu hat (KM)	16.26	nu star (KM)	16.07
theta hat (KM)	3594	theta star (KM)	3637
80% gamma percentile (KM)	1328	90% gamma percentile (KM)	2740
95% gamma percentile (KM)	4414	99% gamma percentile (KM)	8868

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.07, α)	8.009	Adjusted Chi Square Value (16.07, β)	7.705
95% Gamma Approximate KM-UCL (use when n>=50)	1831	95% Gamma Adjusted KM-UCL (use when n<50)	1904

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.929	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.109	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.156	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	912	Mean in Log Scale	5.308
SD in Original Scale	1841	SD in Log Scale	1.881
95% t UCL (assumes normality of ROS data)	1464	95% Percentile Bootstrap UCL	1481
95% BCA Bootstrap UCL	1706	95% Bootstrap t UCL	2338
95% H-UCL (Log ROS)	4069		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.302	KM Geo Mean	200.8
KM SD (logged)	1.866	95% Critical H Value (KM-Log)	3.627
KM Standard Error of Mean (logged)	0.337	95% H-UCL (KM -Log)	3862
KM SD (logged)	1.866	95% Critical H Value (KM-Log)	3.627
KM Standard Error of Mean (logged)	0.337		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	915.8	Mean in Log Scale	5.34
SD in Original Scale	1839	SD in Log Scale	1.871
95% t UCL (Assumes normality)	1467	95% H-Stat UCL	4071

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	1904

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	32	Number of Distinct Observations	26
		Number of Missing Observations	32
Number of Detects	9	Number of Non-Detects	23
Number of Distinct Detects	9	Number of Distinct Non-Detects	17
Minimum Detect	47	Minimum Non-Detect	21
Maximum Detect	1600	Maximum Non-Detect	1300
Variance Detects	248143	Percent Non-Detects	71.88%
Mean Detects	313.7	SD Detects	498.1
Median Detects	80.5	CV Detects	1.588
Skewness Detects	2.668	Kurtosis Detects	7.42
Mean of Logged Detects	5.028	SD of Logged Detects	1.153

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.587	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.321	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	108.9	KM Standard Error of Mean	53.05
KM SD	281.5	95% KM (BCA) UCL	206.4
95% KM (t) UCL	198.9	95% KM (Percentile Bootstrap) UCL	203.1
95% KM (z) UCL	196.2	95% KM Bootstrap t UCL	380.9
90% KM Chebyshev UCL	268.1	95% KM Chebyshev UCL	340.2
97.5% KM Chebyshev UCL	440.2	99% KM Chebyshev UCL	636.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.866	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.749	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.285	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.289	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.821	k star (bias corrected MLE)	0.621
Theta hat (MLE)	382.2	Theta star (bias corrected MLE)	504.9
nu hat (MLE)	14.78	nu star (bias corrected)	11.18
Mean (detects)	313.7		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	88.24
Maximum	1600	Median	0.01
SD	290.8	CV	3.296
k hat (MLE)	0.124	k star (bias corrected MLE)	0.133
Theta hat (MLE)	712.5	Theta star (bias corrected MLE)	663.1
nu hat (MLE)	7.926	nu star (bias corrected)	8.516
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (8.52, α)	3.038	Adjusted Chi Square Value (8.52, β)	2.864
95% Gamma Approximate UCL (use when n>=50)	247.4	95% Gamma Adjusted UCL (use when n<50)	262.4

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	108.9	SD (KM)	281.5
Variance (KM)	79227	SE of Mean (KM)	53.05
k hat (KM)	0.15	k star (KM)	0.157
nu hat (KM)	9.586	nu star (KM)	10.02
theta hat (KM)	727.3	theta star (KM)	695.7
80% gamma percentile (KM)	122.7	90% gamma percentile (KM)	324.8
95% gamma percentile (KM)	594.4	99% gamma percentile (KM)	1370

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.02, α)	3.955	Adjusted Chi Square Value (10.02, β)	3.752
95% Gamma Approximate KM-UCL (use when n>=50)	276	95% Gamma Adjusted KM-UCL (use when n<50)	290.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.867	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.266	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	94.4	Mean in Log Scale	2.846
SD in Original Scale	288.9	SD in Log Scale	1.588
95% t UCL (assumes normality of ROS data)	181	95% Percentile Bootstrap UCL	185.5
95% BCA Bootstrap UCL	261.3	95% Bootstrap t UCL	426.3
95% H-UCL (Log ROS)	152.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.712	KM Geo Mean	40.94
KM SD (logged)	1.069	95% Critical H Value (KM-Log)	2.514
KM Standard Error of Mean (logged)	0.216	95% H-UCL (KM -Log)	117.4
KM SD (logged)	1.069	95% Critical H Value (KM-Log)	2.514
KM Standard Error of Mean (logged)	0.216		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	140.8	Mean in Log Scale	3.941
SD in Original Scale	300.1	SD in Log Scale	1.271
95% t UCL (Assumes normality)	230.8	95% H-Stat UCL	217.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	290.9

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	32	Number of Distinct Observations	26
		Number of Missing Observations	32
Number of Detects	15	Number of Non-Detects	17
Number of Distinct Detects	12	Number of Distinct Non-Detects	14
Minimum Detect	15	Minimum Non-Detect	0.77
Maximum Detect	1200	Maximum Non-Detect	380
Variance Detects	97562	Percent Non-Detects	53.13%
Mean Detects	197.6	SD Detects	312.3
Median Detects	68	CV Detects	1.581
Skewness Detects	2.816	Kurtosis Detects	8.227
Mean of Logged Detects	4.581	SD of Logged Detects	1.136

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.578	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.373	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	95.45	KM Standard Error of Mean	41.87
KM SD	228.4	95% KM (BCA) UCL	178.1
95% KM (t) UCL	166.4	95% KM (Percentile Bootstrap) UCL	170.2
95% KM (z) UCL	164.3	95% KM Bootstrap t UCL	312.5
90% KM Chebyshev UCL	221.1	95% KM Chebyshev UCL	277.9
97.5% KM Chebyshev UCL	356.9	99% KM Chebyshev UCL	512

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.014	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.771	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.269	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.229	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.837	k star (bias corrected MLE)	0.714
Theta hat (MLE)	236.2	Theta star (bias corrected MLE)	276.8
nu hat (MLE)	25.1	nu star (bias corrected)	21.41
Mean (detects)	197.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	92.63
Maximum	1200	Median	0.01
SD	232.6	CV	2.511
k hat (MLE)	0.158	k star (bias corrected MLE)	0.164
Theta hat (MLE)	586.3	Theta star (bias corrected MLE)	564.8
nu hat (MLE)	10.11	nu star (bias corrected)	10.5
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (10.50, α)	4.255	Adjusted Chi Square Value (10.50, β)	4.043
95% Gamma Approximate UCL (use when n>=50)	228.5	95% Gamma Adjusted UCL (use when n<50)	240.5

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	95.45	SD (KM)	228.4
Variance (KM)	52156	SE of Mean (KM)	41.87
k hat (KM)	0.175	k star (KM)	0.179
nu hat (KM)	11.18	nu star (KM)	11.46
theta hat (KM)	546.5	theta star (KM)	532.8
80% gamma percentile (KM)	118.1	90% gamma percentile (KM)	287.8
95% gamma percentile (KM)	505.5	99% gamma percentile (KM)	1116

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.46, α)	4.876	Adjusted Chi Square Value (11.46, β)	4.647
95% Gamma Approximate KM-UCL (use when n>=50)	224.4	95% Gamma Adjusted KM-UCL (use when n<50)	235.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	96.59	Mean in Log Scale	3.15
SD in Original Scale	231	SD in Log Scale	1.603
95% t UCL (assumes normality of ROS data)	165.8	95% Percentile Bootstrap UCL	171.3
95% BCA Bootstrap UCL	199.1	95% Bootstrap t UCL	336.4
95% H-UCL (Log ROS)	214.3		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.149	KM Geo Mean	8.573
KM SD (logged)	2.524	95% Critical H Value (KM-Log)	4.651
KM Standard Error of Mean (logged)	0.476	95% H-UCL (KM -Log)	1707
KM SD (logged)	2.524	95% Critical H Value (KM-Log)	4.651
KM Standard Error of Mean (logged)	0.476		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	103.2	Mean in Log Scale	2.952
SD in Original Scale	231.1	SD in Log Scale	2.047
95% t UCL (Assumes normality)	172.5	95% H-Stat UCL	653.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1707

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(123-cd)pyrene

General Statistics

Total Number of Observations	32	Number of Distinct Observations	28
		Number of Missing Observations	32
Number of Detects	25	Number of Non-Detects	7
Number of Distinct Detects	22	Number of Distinct Non-Detects	6
Minimum Detect	14	Minimum Non-Detect	6.9
Maximum Detect	3500	Maximum Non-Detect	380
Variance Detects	584603	Percent Non-Detects	21.88%
Mean Detects	429.4	SD Detects	764.6
Median Detects	220	CV Detects	1.781
Skewness Detects	3.268	Kurtosis Detects	11.51
Mean of Logged Detects	5.025	SD of Logged Detects	1.517

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.552	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.918	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.329	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.173	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	340	KM Standard Error of Mean	123.4
KM SD	683.8	95% KM (BCA) UCL	580.3
95% KM (t) UCL	549.3	95% KM (Percentile Bootstrap) UCL	551.4
95% KM (z) UCL	543	95% KM Bootstrap t UCL	905.1
90% KM Chebyshev UCL	710.3	95% KM Chebyshev UCL	878
97.5% KM Chebyshev UCL	1111	99% KM Chebyshev UCL	1568

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.75	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.798	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.159	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.183	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.596	k star (bias corrected MLE)	0.551
Theta hat (MLE)	720.1	Theta star (bias corrected MLE)	778.7
nu hat (MLE)	29.81	nu star (bias corrected)	27.57
Mean (detects)	429.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	335.4
Maximum	3500	Median	66.5
SD	696.5	CV	2.076
k hat (MLE)	0.246	k star (bias corrected MLE)	0.244
Theta hat (MLE)	1364	Theta star (bias corrected MLE)	1377
nu hat (MLE)	15.73	nu star (bias corrected)	15.59
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (15.59, α)	7.675	Adjusted Chi Square Value (15.59, β)	7.378
95% Gamma Approximate UCL (use when n>=50)	681.4	95% Gamma Adjusted UCL (use when n<50)	708.9

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(123-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	340	SD (KM)	683.8
Variance (KM)	467568	SE of Mean (KM)	123.4
k hat (KM)	0.247	k star (KM)	0.245
nu hat (KM)	15.83	nu star (KM)	15.68
theta hat (KM)	1375	theta star (KM)	1388
80% gamma percentile (KM)	490.2	90% gamma percentile (KM)	1022
95% gamma percentile (KM)	1656	99% gamma percentile (KM)	3348

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.68, α)	7.734	Adjusted Chi Square Value (15.68, β)	7.435
95% Gamma Approximate KM-UCL (use when n>=50)	689.2	95% Gamma Adjusted KM-UCL (use when n<50)	716.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.918	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.116	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.173	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	338.1	Mean in Log Scale	4.383
SD in Original Scale	695.2	SD in Log Scale	1.855
95% t UCL (assumes normality of ROS data)	546.5	95% Percentile Bootstrap UCL	551.5
95% BCA Bootstrap UCL	677.3	95% Bootstrap t UCL	918.2
95% H-UCL (Log ROS)	1491		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.422	KM Geo Mean	83.22
KM SD (logged)	1.785	95% Critical H Value (KM-Log)	3.505
KM Standard Error of Mean (logged)	0.326	95% H-UCL (KM -Log)	1259
KM SD (logged)	1.785	95% Critical H Value (KM-Log)	3.505
KM Standard Error of Mean (logged)	0.326		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	342.4	Mean in Log Scale	4.373
SD in Original Scale	693.8	SD in Log Scale	1.947
95% t UCL (Assumes normality)	550.4	95% H-Stat UCL	1960

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	716.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	32	Number of Distinct Observations	31
		Number of Missing Observations	32
Minimum	2640	Mean	6844
Maximum	14800	Median	6275
SD	3128	Std. Error of Mean	553
Coefficient of Variation	0.457	Skewness	0.952

Normal GOF Test

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7782	95% Adjusted-CLT UCL (Chen-1995)	7853
		95% Modified-t UCL (Johnson-1978)	7797

Gamma GOF Test

A-D Test Statistic	0.332	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0937	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.156	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.301	k star (bias corrected MLE)	4.825
Theta hat (MLE)	1291	Theta star (bias corrected MLE)	1419
nu hat (MLE)	339.2	nu star (bias corrected)	308.8
MLE Mean (bias corrected)	6844	MLE Sd (bias corrected)	3116
		Approximate Chi Square Value (0.05)	269.1
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	267.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	7854	95% Adjusted Gamma UCL (use when n<50)	7913

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.088	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.879	Mean of logged Data	8.734
Maximum of Logged Data	9.602	SD of logged Data	0.45

Assuming Lognormal Distribution

95% H-UCL	8009	90% Chebyshev (MVUE) UCL	8543
95% Chebyshev (MVUE) UCL	9310	97.5% Chebyshev (MVUE) UCL	10376
99% Chebyshev (MVUE) UCL	12469		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7754	95% Jackknife UCL	7782
95% Standard Bootstrap UCL	7733	95% Bootstrap-t UCL	7942
95% Hall's Bootstrap UCL	7889	95% Percentile Bootstrap UCL	7829
95% BCA Bootstrap UCL	7841		
90% Chebyshev(Mean, Sd) UCL	8503	95% Chebyshev(Mean, Sd) UCL	9255
97.5% Chebyshev(Mean, Sd) UCL	10298	99% Chebyshev(Mean, Sd) UCL	12346

Suggested UCL to Use

95% Student's-t UCL	7782

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	32	Number of Distinct Observations	32
		Number of Missing Observations	32
Number of Detects	29	Number of Non-Detects	3
Number of Distinct Detects	29	Number of Distinct Non-Detects	3
Minimum Detect	0.2	Minimum Non-Detect	0.31
Maximum Detect	669	Maximum Non-Detect	7.2
Variance Detects	17801	Percent Non-Detects	9.375%
Mean Detects	47.39	SD Detects	133.4
Median Detects	5.2	CV Detects	2.815
Skewness Detects	4.062	Kurtosis Detects	17.88
Mean of Logged Detects	1.823	SD of Logged Detects	1.912

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.398	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.926	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.417	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.161	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	43.08	KM Standard Error of Mean	22.58
KM SD	125.5	95% KM (BCA) UCL	88.24
95% KM (t) UCL	81.37	95% KM (Percentile Bootstrap) UCL	82.58
95% KM (z) UCL	80.23	95% KM Bootstrap t UCL	157.6
90% KM Chebyshev UCL	110.8	95% KM Chebyshev UCL	141.5
97.5% KM Chebyshev UCL	184.1	99% KM Chebyshev UCL	267.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.652	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.849	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.264	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.176	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.333	k star (bias corrected MLE)	0.322
Theta hat (MLE)	142.3	Theta star (bias corrected MLE)	147.3
nu hat (MLE)	19.32	nu star (bias corrected)	18.66
Mean (detects)	47.39		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	42.95
Maximum	669	Median	4.125
SD	127.6	CV	2.97
k hat (MLE)	0.275	k star (bias corrected MLE)	0.27
Theta hat (MLE)	156	Theta star (bias corrected MLE)	158.8
nu hat (MLE)	17.62	nu star (bias corrected)	17.31
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (17.31, α)	8.891	Adjusted Chi Square Value (17.31, β)	8.568
95% Gamma Approximate UCL (use when n>=50)	83.59	95% Gamma Adjusted UCL (use when n<50)	86.75

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	43.08	SD (KM)	125.5
Variance (KM)	15755	SE of Mean (KM)	22.58
k hat (KM)	0.118	k star (KM)	0.128
nu hat (KM)	7.541	nu star (KM)	8.167
theta hat (KM)	365.7	theta star (KM)	337.6
80% gamma percentile (KM)	40.39	90% gamma percentile (KM)	124
95% gamma percentile (KM)	243.8	99% gamma percentile (KM)	604

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.17, α)	2.832	Adjusted Chi Square Value (8.17, β)	2.666
95% Gamma Approximate KM-UCL (use when n>=50)	124.2	95% Gamma Adjusted KM-UCL (use when n<50)	132

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.926	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.108	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.161	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	43.05	Mean in Log Scale	1.614
SD in Original Scale	127.5	SD in Log Scale	1.971
95% t UCL (assumes normality of ROS data)	81.28	95% Percentile Bootstrap UCL	84.88
95% BCA Bootstrap UCL	106.8	95% Bootstrap t UCL	161.4
95% H-UCL (Log ROS)	133.8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.623	KM Geo Mean	5.069
KM SD (logged)	1.931	95% Critical H Value (KM-Log)	3.725
KM Standard Error of Mean (logged)	0.351	95% H-UCL (KM -Log)	118.9
KM SD (logged)	1.931	95% Critical H Value (KM-Log)	3.725
KM Standard Error of Mean (logged)	0.351		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	43.16	Mean in Log Scale	1.67
SD in Original Scale	127.5	SD in Log Scale	1.934
95% t UCL (Assumes normality)	81.38	95% H-Stat UCL	125.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	141.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	32	Number of Distinct Observations	29
		Number of Missing Observations	32
Minimum	4	Mean	14.91
Maximum	57.3	Median	12.05
SD	11.04	Std. Error of Mean	1.952
Coefficient of Variation	0.741	Skewness	2.07

Normal GOF Test

Shapiro Wilk Test Statistic	0.798	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	18.22	95% Adjusted-CLT UCL (Chen-1995)	18.88
		95% Modified-t UCL (Johnson-1978)	18.34

Gamma GOF Test

A-D Test Statistic	0.644	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.152	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.157	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.524	k star (bias corrected MLE)	2.308
Theta hat (MLE)	5.907	Theta star (bias corrected MLE)	6.46
nu hat (MLE)	161.5	nu star (bias corrected)	147.7
MLE Mean (bias corrected)	14.91	MLE Sd (bias corrected)	9.814
		Approximate Chi Square Value (0.05)	120.6
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	119.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	18.26	95% Adjusted Gamma UCL (use when n<50)	18.46

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.132	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.386	Mean of logged Data	2.491
Maximum of Logged Data	4.048	SD of logged Data	0.642

Assuming Lognormal Distribution

95% H-UCL	18.81	90% Chebyshev (MVUE) UCL	20.1
95% Chebyshev (MVUE) UCL	22.54	97.5% Chebyshev (MVUE) UCL	25.92
99% Chebyshev (MVUE) UCL	32.56		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	18.12	95% Jackknife UCL	18.22
95% Standard Bootstrap UCL	18.12	95% Bootstrap-t UCL	19.36
95% Hall's Bootstrap UCL	20.63	95% Percentile Bootstrap UCL	18.41
95% BCA Bootstrap UCL	18.61		
90% Chebyshev(Mean, Sd) UCL	20.77	95% Chebyshev(Mean, Sd) UCL	23.42
97.5% Chebyshev(Mean, Sd) UCL	27.1	99% Chebyshev(Mean, Sd) UCL	34.33

Suggested UCL to Use

95% Adjusted Gamma UCL	18.46

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	32	Number of Distinct Observations	32
		Number of Missing Observations	32
Minimum	29.5	Mean	549
Maximum	4370	Median	266.5
SD	840.8	Std. Error of Mean	148.6
Coefficient of Variation	1.531	Skewness	3.385

Normal GOF Test

Shapiro Wilk Test Statistic	0.597	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.288	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	801.1	95% Adjusted-CLT UCL (Chen-1995)	888.6
		95% Modified-t UCL (Johnson-1978)	815.9

Gamma GOF Test

A-D Test Statistic	1.023	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.784	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.145	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.161	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.827	k star (bias corrected MLE)	0.77
Theta hat (MLE)	664.2	Theta star (bias corrected MLE)	713.1
nu hat (MLE)	52.9	nu star (bias corrected)	49.28
MLE Mean (bias corrected)	549	MLE Sd (bias corrected)	625.7
		Approximate Chi Square Value (0.05)	34.16
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	33.49

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	792	95% Adjusted Gamma UCL (use when n<50)	807.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.109	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.384	Mean of logged Data	5.593
Maximum of Logged Data	8.383	SD of logged Data	1.183

Assuming Lognormal Distribution

95% H-UCL	950.7	90% Chebyshev (MVUE) UCL	913.9
95% Chebyshev (MVUE) UCL	1092	97.5% Chebyshev (MVUE) UCL	1338
99% Chebyshev (MVUE) UCL	1822		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	793.5	95% Jackknife UCL	801.1
95% Standard Bootstrap UCL	794.6	95% Bootstrap-t UCL	1018
95% Hall's Bootstrap UCL	1769	95% Percentile Bootstrap UCL	799.8
95% BCA Bootstrap UCL	900.4		
90% Chebyshev(Mean, Sd) UCL	995	95% Chebyshev(Mean, Sd) UCL	1197
97.5% Chebyshev(Mean, Sd) UCL	1477	99% Chebyshev(Mean, Sd) UCL	2028

Suggested UCL to Use

95% Adjusted Gamma UCL	807.9

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	32	Number of Distinct Observations	32
		Number of Missing Observations	32
Number of Detects	31	Number of Non-Detects	1
Number of Distinct Detects	31	Number of Distinct Non-Detects	1
Minimum Detect	0.14	Minimum Non-Detect	0.23
Maximum Detect	46.1	Maximum Non-Detect	0.23
Variance Detects	162.7	Percent Non-Detects	3.125%
Mean Detects	7.577	SD Detects	12.76
Median Detects	1.6	CV Detects	1.684
Skewness Detects	1.98	Kurtosis Detects	2.889
Mean of Logged Detects	0.56	SD of Logged Detects	1.818

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.636	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.32	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.156	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.346	KM Standard Error of Mean	2.231
KM SD	12.42	95% KM (BCA) UCL	11.19
95% KM (t) UCL	11.13	95% KM (Percentile Bootstrap) UCL	11.36
95% KM (z) UCL	11.02	95% KM Bootstrap t UCL	12.55
90% KM Chebyshev UCL	14.04	95% KM Chebyshev UCL	17.07
97.5% KM Chebyshev UCL	21.28	99% KM Chebyshev UCL	29.55

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.67	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.823	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.182	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.168	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.442	k star (bias corrected MLE)	0.421
Theta hat (MLE)	17.14	Theta star (bias corrected MLE)	18
nu hat (MLE)	27.41	nu star (bias corrected)	26.09
Mean (detects)	7.577		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	7.34
Maximum	46.1	Median	1.5
SD	12.62	CV	1.719
k hat (MLE)	0.411	k star (bias corrected MLE)	0.393
Theta hat (MLE)	17.86	Theta star (bias corrected MLE)	18.67
nu hat (MLE)	26.3	nu star (bias corrected)	25.17
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (25.17, α)	14.74	Adjusted Chi Square Value (25.17, β)	14.31
95% Gamma Approximate UCL (use when n>=50)	12.53	95% Gamma Adjusted UCL (use when n<50)	12.91

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.346	SD (KM)	12.42
Variance (KM)	154.2	SE of Mean (KM)	2.231
k hat (KM)	0.35	k star (KM)	0.338
nu hat (KM)	22.4	nu star (KM)	21.63
theta hat (KM)	20.99	theta star (KM)	21.73
80% gamma percentile (KM)	11.56	90% gamma percentile (KM)	21.32
95% gamma percentile (KM)	32.32	99% gamma percentile (KM)	60.49

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (21.63, α)	12.06	Adjusted Chi Square Value (21.63, β)	11.68
95% Gamma Approximate KM-UCL (use when n>=50)	13.17	95% Gamma Adjusted KM-UCL (use when n<50)	13.61

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.911	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.929	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.156	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	7.342	Mean in Log Scale	0.465
SD in Original Scale	12.62	SD in Log Scale	1.869
95% t UCL (assumes normality of ROS data)	11.12	95% Percentile Bootstrap UCL	11.12
95% BCA Bootstrap UCL	12.18	95% Bootstrap t UCL	12.57
95% H-UCL (Log ROS)	30.85		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.49	KM Geo Mean	1.633
KM SD (logged)	1.804	95% Critical H Value (KM-Log)	3.533
KM Standard Error of Mean (logged)	0.324	95% H-UCL (KM -Log)	26.09
KM SD (logged)	1.804	95% Critical H Value (KM-Log)	3.533
KM Standard Error of Mean (logged)	0.324		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7.343	Mean in Log Scale	0.475
SD in Original Scale	12.62	SD in Log Scale	1.853
95% t UCL (Assumes normality)	11.13	95% H-Stat UCL	29.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	17.07

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI

General Statistics

Total Number of Observations	32	Number of Distinct Observations	21
		Number of Missing Observations	32
Number of Detects	26	Number of Non-Detects	6
Number of Distinct Detects	20	Number of Distinct Non-Detects	4
Minimum Detect	0.31	Minimum Non-Detect	1.4
Maximum Detect	19.7	Maximum Non-Detect	3.3
Variance Detects	24.5	Percent Non-Detects	18.75%
Mean Detects	3.955	SD Detects	4.95
Median Detects	1.8	CV Detects	1.251
Skewness Detects	2.018	Kurtosis Detects	3.428
Mean of Logged Detects	0.823	SD of Logged Detects	1.014

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.67	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.315	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.418	KM Standard Error of Mean	0.816
KM SD	4.52	95% KM (BCA) UCL	4.807
95% KM (t) UCL	4.801	95% KM (Percentile Bootstrap) UCL	4.756
95% KM (z) UCL	4.76	95% KM Bootstrap t UCL	5.566
90% KM Chebyshev UCL	5.865	95% KM Chebyshev UCL	6.974
97.5% KM Chebyshev UCL	8.512	99% KM Chebyshev UCL	11.53

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.724	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.772	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.242	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.176	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.041	k star (bias corrected MLE)	0.947
Theta hat (MLE)	3.799	Theta star (bias corrected MLE)	4.179
nu hat (MLE)	54.14	nu star (bias corrected)	49.22
Mean (detects)	3.955		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.266
Maximum	19.7	Median	1.6
SD	4.68	CV	1.433
k hat (MLE)	0.613	k star (bias corrected MLE)	0.576
Theta hat (MLE)	5.329	Theta star (bias corrected MLE)	5.668
nu hat (MLE)	39.22	nu star (bias corrected)	36.88
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (36.88, α)	23.98	Adjusted Chi Square Value (36.88, β)	23.42
95% Gamma Approximate UCL (use when n>=50)	5.023	95% Gamma Adjusted UCL (use when n<50)	5.143

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.418	SD (KM)	4.52
Variance (KM)	20.43	SE of Mean (KM)	0.816
k hat (KM)	0.572	k star (KM)	0.539
nu hat (KM)	36.6	nu star (KM)	34.5
theta hat (KM)	5.978	theta star (KM)	6.341
80% gamma percentile (KM)	5.628	90% gamma percentile (KM)	9.102
95% gamma percentile (KM)	12.78	99% gamma percentile (KM)	21.77

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (34.50, α)	22.06	Adjusted Chi Square Value (34.50, β)	21.53
95% Gamma Approximate KM-UCL (use when n>=50)	5.345	95% Gamma Adjusted KM-UCL (use when n<50)	5.477

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.186	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.403	Mean in Log Scale	0.66
SD in Original Scale	4.598	SD in Log Scale	0.986
95% t UCL (assumes normality of ROS data)	4.781	95% Percentile Bootstrap UCL	4.78
95% BCA Bootstrap UCL	5.1	95% Bootstrap t UCL	5.426
95% H-UCL (Log ROS)	4.824		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.666	KM Geo Mean	1.946
KM SD (logged)	0.978	95% Critical H Value (KM-Log)	2.405
KM Standard Error of Mean (logged)	0.181	95% H-UCL (KM -Log)	4.786
KM SD (logged)	0.978	95% Critical H Value (KM-Log)	2.405
KM Standard Error of Mean (logged)	0.181		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.403	Mean in Log Scale	0.658
SD in Original Scale	4.599	SD in Log Scale	0.988
95% t UCL (Assumes normality)	4.781	95% H-Stat UCL	4.829

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	4.786

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	32	Number of Distinct Observations	27
		Number of Missing Observations	32
Minimum	2.1	Mean	10.57
Maximum	38	Median	6.8
SD	9.605	Std. Error of Mean	1.698
Coefficient of Variation	0.909	Skewness	1.838

Normal GOF Test

Shapiro Wilk Test Statistic	0.739	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	13.45	95% Adjusted-CLT UCL (Chen-1995)	13.95
		95% Modified-t UCL (Johnson-1978)	13.54

Gamma GOF Test

A-D Test Statistic	1.4	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.761	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.191	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.158	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.804	k star (bias corrected MLE)	1.656
Theta hat (MLE)	5.858	Theta star (bias corrected MLE)	6.383
nu hat (MLE)	115.5	nu star (bias corrected)	106
MLE Mean (bias corrected)	10.57	MLE Sd (bias corrected)	8.214
		Approximate Chi Square Value (0.05)	83.23
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	82.15

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	13.46	95% Adjusted Gamma UCL (use when n<50)	13.64

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.137	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.742	Mean of logged Data	2.056
Maximum of Logged Data	3.638	SD of logged Data	0.751

Assuming Lognormal Distribution

95% H-UCL	13.85	90% Chebyshev (MVUE) UCL	14.71
95% Chebyshev (MVUE) UCL	16.73	97.5% Chebyshev (MVUE) UCL	19.53
99% Chebyshev (MVUE) UCL	25.04		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13.36	95% Jackknife UCL	13.45
95% Standard Bootstrap UCL	13.32	95% Bootstrap-t UCL	14.58
95% Hall's Bootstrap UCL	14.21	95% Percentile Bootstrap UCL	13.47
95% BCA Bootstrap UCL	13.77		
90% Chebyshev(Mean, Sd) UCL	15.66	95% Chebyshev(Mean, Sd) UCL	17.97
97.5% Chebyshev(Mean, Sd) UCL	21.17	99% Chebyshev(Mean, Sd) UCL	27.46

Suggested UCL to Use

95% H-UCL	13.85

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	32	Number of Distinct Observations	32
		Number of Missing Observations	32
Minimum	8.1	Mean	2405
Maximum	43400	Median	137.3
SD	7840	Std. Error of Mean	1386
Coefficient of Variation	3.261	Skewness	4.946

Normal GOF Test

Shapiro Wilk Test Statistic	0.339	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4754	95% Adjusted-CLT UCL (Chen-1995)	5979
		95% Modified-t UCL (Johnson-1978)	4956

Gamma GOF Test

A-D Test Statistic	2.607	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.87	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.17	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.27	k star (bias corrected MLE)	0.265
Theta hat (MLE)	8917	Theta star (bias corrected MLE)	9067
nu hat (MLE)	17.26	nu star (bias corrected)	16.97
MLE Mean (bias corrected)	2405	MLE Sd (bias corrected)	4669
		Approximate Chi Square Value (0.05)	8.653
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	8.335

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4717	95% Adjusted Gamma UCL (use when n<50)	4897

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.092	Mean of logged Data	5.183
Maximum of Logged Data	10.68	SD of logged Data	2.29

Assuming Lognormal Distribution

95% H-UCL	14243	90% Chebyshev (MVUE) UCL	5142
95% Chebyshev (MVUE) UCL	6604	97.5% Chebyshev (MVUE) UCL	8633
99% Chebyshev (MVUE) UCL	12619		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	4684	95% Jackknife UCL	4754
95% Standard Bootstrap UCL	4571	95% Bootstrap-t UCL	11607
95% Hall's Bootstrap UCL	11741	95% Percentile Bootstrap UCL	4942
95% BCA Bootstrap UCL	6929		
90% Chebyshev(Mean, Sd) UCL	6562	95% Chebyshev(Mean, Sd) UCL	8446
97.5% Chebyshev(Mean, Sd) UCL	11060	99% Chebyshev(Mean, Sd) UCL	16195

Suggested UCL to Use

97.5% Chebyshev (Mean, Sd) UCL	11060

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide

General Statistics

Total Number of Observations	28	Number of Distinct Observations	23
		Number of Missing Observations	36
Number of Detects	13	Number of Non-Detects	15
Number of Distinct Detects	13	Number of Distinct Non-Detects	10
Minimum Detect	0.29	Minimum Non-Detect	0.17
Maximum Detect	13	Maximum Non-Detect	0.64
Variance Detects	13.72	Percent Non-Detects	53.57%
Mean Detects	2.409	SD Detects	3.704
Median Detects	0.83	CV Detects	1.538
Skewness Detects	2.364	Kurtosis Detects	5.642
Mean of Logged Detects	0.0836	SD of Logged Detects	1.219

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.632	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.35	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.299	KM Standard Error of Mean	0.52
KM SD	2.638	95% KM (BCA) UCL	2.303
95% KM (t) UCL	2.184	95% KM (Percentile Bootstrap) UCL	2.192
95% KM (z) UCL	2.153	95% KM Bootstrap t UCL	3.907
90% KM Chebyshev UCL	2.857	95% KM Chebyshev UCL	3.563
97.5% KM Chebyshev UCL	4.543	99% KM Chebyshev UCL	6.468

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.08	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.77	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.32	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.246	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.752	k star (bias corrected MLE)	0.63
Theta hat (MLE)	3.204	Theta star (bias corrected MLE)	3.826
nu hat (MLE)	19.55	nu star (bias corrected)	16.37
Mean (detects)	2.409		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.124
Maximum	13	Median	0.01
SD	2.754	CV	2.45
k hat (MLE)	0.275	k star (bias corrected MLE)	0.269
Theta hat (MLE)	4.089	Theta star (bias corrected MLE)	4.175
nu hat (MLE)	15.39	nu star (bias corrected)	15.08
Adjusted Level of Significance (β)	0.0404		
Approximate Chi Square Value (15.08, α)	7.314	Adjusted Chi Square Value (15.08, β)	6.98
95% Gamma Approximate UCL (use when n>=50)	2.317	95% Gamma Adjusted UCL (use when n<50)	2.427

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.299	SD (KM)	2.638
Variance (KM)	6.957	SE of Mean (KM)	0.52
k hat (KM)	0.242	k star (KM)	0.24
nu hat (KM)	13.58	nu star (KM)	13.46
theta hat (KM)	5.356	theta star (KM)	5.404
80% gamma percentile (KM)	1.859	90% gamma percentile (KM)	3.908
95% gamma percentile (KM)	6.361	99% gamma percentile (KM)	12.92

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.46, α)	6.202	Adjusted Chi Square Value (13.46, β)	5.898
95% Gamma Approximate KM-UCL (use when n>=50)	2.818	95% Gamma Adjusted KM-UCL (use when n<50)	2.963

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.254	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.234	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.265	Mean in Log Scale	-0.724
SD in Original Scale	2.699	SD in Log Scale	1.191
95% t UCL (assumes normality of ROS data)	2.134	95% Percentile Bootstrap UCL	2.194
95% BCA Bootstrap UCL	2.535	95% Bootstrap t UCL	3.869
95% H-UCL (Log ROS)	1.83		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.58	KM Geo Mean	0.56
KM SD (logged)	1.046	95% Critical H Value (KM-Log)	2.513
KM Standard Error of Mean (logged)	0.224	95% H-UCL (KM -Log)	1.605
KM SD (logged)	1.046	95% Critical H Value (KM-Log)	2.513
KM Standard Error of Mean (logged)	0.224		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.26	Mean in Log Scale	-0.695
SD in Original Scale	2.7	SD in Log Scale	1.12
95% t UCL (Assumes normality)	2.129	95% H-Stat UCL	1.64

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1.605

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	32	Number of Distinct Observations	30
		Number of Missing Observations	32
Minimum	6340	Mean	24811
Maximum	135000	Median	14800
SD	30330	Std. Error of Mean	5362
Coefficient of Variation	1.222	Skewness	2.922

Normal GOF Test

Shapiro Wilk Test Statistic	0.54	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.329	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	33902	95% Adjusted-CLT UCL (Chen-1995)	36590
		95% Modified-t UCL (Johnson-1978)	34364

Gamma GOF Test

A-D Test Statistic	2.961	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.764	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.25	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.158	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.554	k star (bias corrected MLE)	1.429
Theta hat (MLE)	15964	Theta star (bias corrected MLE)	17359
nu hat (MLE)	99.47	nu star (bias corrected)	91.47
MLE Mean (bias corrected)	24811	MLE Sd (bias corrected)	20753
		Approximate Chi Square Value (0.05)	70.42
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	69.43

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	32229	95% Adjusted Gamma UCL (use when n<50)	32688

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.755	Mean of logged Data	9.764
Maximum of Logged Data	11.81	SD of logged Data	0.729

Assuming Lognormal Distribution

95% H-UCL	30020	90% Chebyshev (MVUE) UCL	31928
95% Chebyshev (MVUE) UCL	36216	97.5% Chebyshev (MVUE) UCL	42167
99% Chebyshev (MVUE) UCL	53857		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	33630	95% Jackknife UCL	33902
95% Standard Bootstrap UCL	33431	95% Bootstrap-t UCL	43343
95% Hall's Bootstrap UCL	36391	95% Percentile Bootstrap UCL	33813
95% BCA Bootstrap UCL	36087		
90% Chebyshev(Mean, Sd) UCL	40896	95% Chebyshev(Mean, Sd) UCL	48182
97.5% Chebyshev(Mean, Sd) UCL	58295	99% Chebyshev(Mean, Sd) UCL	78159

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 48182

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	32	Number of Distinct Observations	32
		Number of Missing Observations	32
Minimum	5.4	Mean	940
Maximum	14100	Median	94.05
SD	2591	Std. Error of Mean	458.1
Coefficient of Variation	2.757	Skewness	4.57

Normal GOF Test

Shapiro Wilk Test Statistic	0.399	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.359	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1717	95% Adjusted-CLT UCL (Chen-1995)	2089
		95% Modified-t UCL (Johnson-1978)	1778

Gamma GOF Test

A-D Test Statistic	1.818	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.848	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.193	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.168	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.329	k star (bias corrected MLE)	0.319
Theta hat (MLE)	2859	Theta star (bias corrected MLE)	2949
nu hat (MLE)	21.04	nu star (bias corrected)	20.4
MLE Mean (bias corrected)	940	MLE Sd (bias corrected)	1665
		Approximate Chi Square Value (0.05)	11.15
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	10.78

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1720	95% Adjusted Gamma UCL (use when n<50)	1779

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.951	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.115	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.686	Mean of logged Data	4.78
Maximum of Logged Data	9.554	SD of logged Data	2.102

Assuming Lognormal Distribution

95% H-UCL	4882	90% Chebyshev (MVUE) UCL	2268
95% Chebyshev (MVUE) UCL	2889	97.5% Chebyshev (MVUE) UCL	3752
99% Chebyshev (MVUE) UCL	5445		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1693	95% Jackknife UCL	1717
95% Standard Bootstrap UCL	1676	95% Bootstrap-t UCL	3254
95% Hall's Bootstrap UCL	4049	95% Percentile Bootstrap UCL	1784
95% BCA Bootstrap UCL	2399		
90% Chebyshev(Mean, Sd) UCL	2314	95% Chebyshev(Mean, Sd) UCL	2937
97.5% Chebyshev(Mean, Sd) UCL	3801	99% Chebyshev(Mean, Sd) UCL	5498

Suggested UCL to Use

97.5% Chebyshev (Mean, Sd) UCL	3801

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	7
Minimum	20	Mean	1119
Maximum	4500	Median	320
SD	1909	Std. Error of Mean	853.6
Coefficient of Variation	1.706	Skewness	2.131

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.672	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.389	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2939	95% Adjusted-CLT UCL (Chen-1995)	3392
		95% Modified-t UCL (Johnson-1978)	3074

Gamma GOF Test

A-D Test Statistic	0.293	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.216	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.374	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.448	k star (bias corrected MLE)	0.312
Theta hat (MLE)	2498	Theta star (bias corrected MLE)	3581
nu hat (MLE)	4.479	nu star (bias corrected)	3.125
MLE Mean (bias corrected)	1119	MLE Sd (bias corrected)	2002
		Approximate Chi Square Value (0.05)	0.41
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.154

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	8521	95% Adjusted Gamma UCL (use when n<50)	22706

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.986	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.148	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.996	Mean of logged Data	5.577
Maximum of Logged Data	8.412	SD of logged Data	2.099

Assuming Lognormal Distribution

95% H-UCL	73004129	90% Chebyshev (MVUE) UCL	3609
95% Chebyshev (MVUE) UCL	4745	97.5% Chebyshev (MVUE) UCL	6322
99% Chebyshev (MVUE) UCL	9419		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2523	95% Jackknife UCL	2939
95% Standard Bootstrap UCL	2369	95% Bootstrap-t UCL	13428
95% Hall's Bootstrap UCL	12297	95% Percentile Bootstrap UCL	2726
95% BCA Bootstrap UCL	2851		
90% Chebyshev(Mean, Sd) UCL	3680	95% Chebyshev(Mean, Sd) UCL	4840
97.5% Chebyshev(Mean, Sd) UCL	6450	99% Chebyshev(Mean, Sd) UCL	9612

Suggested UCL to Use

95% Adjusted Gamma UCL	22706

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	7
Minimum	47	Mean	775.4
Maximum	2500	Median	300
SD	1024	Std. Error of Mean	458
Coefficient of Variation	1.321	Skewness	1.686

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.795	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1752	95% Adjusted-CLT UCL (Chen-1995)	1898
		95% Modified-t UCL (Johnson-1978)	1809

Gamma GOF Test

A-D Test Statistic	0.247	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.701	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.202	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.368	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.693	k star (bias corrected MLE)	0.411
Theta hat (MLE)	1118	Theta star (bias corrected MLE)	1888
nu hat (MLE)	6.933	nu star (bias corrected)	4.107
MLE Mean (bias corrected)	775.4	MLE Sd (bias corrected)	1210
		Approximate Chi Square Value (0.05)	0.764
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.319

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4166	95% Adjusted Gamma UCL (use when n<50)	9976

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.85	Mean of logged Data	5.781
Maximum of Logged Data	7.824	SD of logged Data	1.594

Assuming Lognormal Distribution

95% H-UCL	471618	90% Chebyshev (MVUE) UCL	2277
95% Chebyshev (MVUE) UCL	2952	97.5% Chebyshev (MVUE) UCL	3889
99% Chebyshev (MVUE) UCL	5730		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1529	95% Jackknife UCL	1752
95% Standard Bootstrap UCL	1465	95% Bootstrap-t UCL	5982
95% Hall's Bootstrap UCL	5305	95% Percentile Bootstrap UCL	1552
95% BCA Bootstrap UCL	1706		
90% Chebyshev(Mean, Sd) UCL	2149	95% Chebyshev(Mean, Sd) UCL	2772
97.5% Chebyshev(Mean, Sd) UCL	3635	99% Chebyshev(Mean, Sd) UCL	5332

Suggested UCL to Use

95% Student's-t UCL	1752

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	7
Minimum	22	Mean	1051
Maximum	4100	Median	320
SD	1728	Std. Error of Mean	772.7
Coefficient of Variation	1.644	Skewness	2.092

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.69	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2698	95% Adjusted-CLT UCL (Chen-1995)	3094
		95% Modified-t UCL (Johnson-1978)	2819

Gamma GOF Test

A-D Test Statistic	0.271	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.714	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.195	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.373	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.477	k star (bias corrected MLE)	0.324
Theta hat (MLE)	2205	Theta star (bias corrected MLE)	3244
nu hat (MLE)	4.767	nu star (bias corrected)	3.24
MLE Mean (bias corrected)	1051	MLE Sd (bias corrected)	1846
		Approximate Chi Square Value (0.05)	0.447
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.169

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	7619	95% Adjusted Gamma UCL (use when n<50)	20150

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.989	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.091	Mean of logged Data	5.615
Maximum of Logged Data	8.319	SD of logged Data	2.027

Assuming Lognormal Distribution

95% H-UCL	33021031	90% Chebyshev (MVUE) UCL	3406
95% Chebyshev (MVUE) UCL	4471	97.5% Chebyshev (MVUE) UCL	5950
99% Chebyshev (MVUE) UCL	8855		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2322	95% Jackknife UCL	2698
95% Standard Bootstrap UCL	2207	95% Bootstrap-t UCL	11302
95% Hall's Bootstrap UCL	11605	95% Percentile Bootstrap UCL	2479
95% BCA Bootstrap UCL	2672		
90% Chebyshev(Mean, Sd) UCL	3369	95% Chebyshev(Mean, Sd) UCL	4419
97.5% Chebyshev(Mean, Sd) UCL	5877	99% Chebyshev(Mean, Sd) UCL	8740

Suggested UCL to Use

95% Adjusted Gamma UCL	20150

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	32	Number of Distinct Observations	30
		Number of Missing Observations	32
Minimum	80.3	Mean	451.3
Maximum	1490	Median	425
SD	277.6	Std. Error of Mean	49.08
Coefficient of Variation	0.615	Skewness	1.859

Normal GOF Test

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.174	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	534.5	95% Adjusted-CLT UCL (Chen-1995)	549.3
		95% Modified-t UCL (Johnson-1978)	537.2

Gamma GOF Test

A-D Test Statistic	0.328	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.753	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.104	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.157	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.122	k star (bias corrected MLE)	2.85
Theta hat (MLE)	144.6	Theta star (bias corrected MLE)	158.4
nu hat (MLE)	199.8	nu star (bias corrected)	182.4
MLE Mean (bias corrected)	451.3	MLE Sd (bias corrected)	267.3
		Approximate Chi Square Value (0.05)	152.1
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	150.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	541	95% Adjusted Gamma UCL (use when n<50)	546.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.976	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.12	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.386	Mean of logged Data	5.943
Maximum of Logged Data	7.307	SD of logged Data	0.608

Assuming Lognormal Distribution

95% H-UCL	571.7	90% Chebyshev (MVUE) UCL	611.7
95% Chebyshev (MVUE) UCL	682.5	97.5% Chebyshev (MVUE) UCL	780.7
99% Chebyshev (MVUE) UCL	973.7		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	532	95% Jackknife UCL	534.5
95% Standard Bootstrap UCL	531.7	95% Bootstrap-t UCL	567.4
95% Hall's Bootstrap UCL	600.9	95% Percentile Bootstrap UCL	538.1
95% BCA Bootstrap UCL	547.9		
90% Chebyshev(Mean, Sd) UCL	598.5	95% Chebyshev(Mean, Sd) UCL	665.2
97.5% Chebyshev(Mean, Sd) UCL	757.8	99% Chebyshev(Mean, Sd) UCL	939.6

Suggested UCL to Use

95% Adjusted Gamma UCL	546.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	32	Number of Distinct Observations	30
		Number of Missing Observations	32
Number of Detects	29	Number of Non-Detects	3
Number of Distinct Detects	27	Number of Distinct Non-Detects	3
Minimum Detect	0.016	Minimum Non-Detect	0.02
Maximum Detect	2.2	Maximum Non-Detect	0.12
Variance Detects	0.181	Percent Non-Detects	9.375%
Mean Detects	0.254	SD Detects	0.425
Median Detects	0.089	CV Detects	1.673
Skewness Detects	3.758	Kurtosis Detects	16.28
Mean of Logged Detects	-2.124	SD of Logged Detects	1.207

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.545	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.926	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.288	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.161	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.234	KM Standard Error of Mean	0.0725
KM SD	0.403	95% KM (BCA) UCL	0.36
95% KM (t) UCL	0.357	95% KM (Percentile Bootstrap) UCL	0.368
95% KM (z) UCL	0.353	95% KM Bootstrap t UCL	0.529
90% KM Chebyshev UCL	0.452	95% KM Chebyshev UCL	0.55
97.5% KM Chebyshev UCL	0.687	99% KM Chebyshev UCL	0.955

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.961	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.782	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.17	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.169	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.788	k star (bias corrected MLE)	0.73
Theta hat (MLE)	0.323	Theta star (bias corrected MLE)	0.348
nu hat (MLE)	45.71	nu star (bias corrected)	42.32
Mean (detects)	0.254		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.231
Maximum	2.2	Median	0.0845
SD	0.411	CV	1.775
k hat (MLE)	0.68	k star (bias corrected MLE)	0.637
Theta hat (MLE)	0.34	Theta star (bias corrected MLE)	0.363
nu hat (MLE)	43.5	nu star (bias corrected)	40.76
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (40.76, α)	27.13	Adjusted Chi Square Value (40.76, β)	26.53
95% Gamma Approximate UCL (use when n>=50)	0.348	95% Gamma Adjusted UCL (use when n<50)	0.355

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.234	SD (KM)	0.403
Variance (KM)	0.162	SE of Mean (KM)	0.0725
k hat (KM)	0.338	k star (KM)	0.327
nu hat (KM)	21.61	nu star (KM)	20.92
theta hat (KM)	0.693	theta star (KM)	0.716
80% gamma percentile (KM)	0.366	90% gamma percentile (KM)	0.683
95% gamma percentile (KM)	1.041	99% gamma percentile (KM)	1.964

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.92, α)	11.53	Adjusted Chi Square Value (20.92, β)	11.16
95% Gamma Approximate KM-UCL (use when n>=50)	0.425	95% Gamma Adjusted KM-UCL (use when n<50)	0.439

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.974	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.926	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.114	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.161	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.234	Mean in Log Scale	-2.25
SD in Original Scale	0.409	SD in Log Scale	1.23
95% t UCL (assumes normality of ROS data)	0.357	95% Percentile Bootstrap UCL	0.362
95% BCA Bootstrap UCL	0.418	95% Bootstrap t UCL	0.522
95% H-UCL (Log ROS)	0.41		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.249	KM Geo Mean	0.105
KM SD (logged)	1.212	95% Critical H Value (KM-Log)	2.697
KM Standard Error of Mean (logged)	0.22	95% H-UCL (KM -Log)	0.395
KM SD (logged)	1.212	95% Critical H Value (KM-Log)	2.697
KM Standard Error of Mean (logged)	0.22		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.234	Mean in Log Scale	-2.247
SD in Original Scale	0.409	SD in Log Scale	1.238
95% t UCL (Assumes normality)	0.357	95% H-Stat UCL	0.418

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.395

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	32	Number of Distinct Observations	31
		Number of Missing Observations	32
Minimum	6.4	Mean	64.7
Maximum	475	Median	19
SD	112.9	Std. Error of Mean	19.96
Coefficient of Variation	1.745	Skewness	2.772

Normal GOF Test

Shapiro Wilk Test Statistic	0.533	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.329	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	98.54	95% Adjusted-CLT UCL (Chen-1995)	108
		95% Modified-t UCL (Johnson-1978)	100.2

Gamma GOF Test

A-D Test Statistic	2.902	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.789	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.246	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.162	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.738	k star (bias corrected MLE)	0.69
Theta hat (MLE)	87.63	Theta star (bias corrected MLE)	93.78
nu hat (MLE)	47.25	nu star (bias corrected)	44.16
MLE Mean (bias corrected)	64.7	MLE Sd (bias corrected)	77.89
		Approximate Chi Square Value (0.05)	29.92
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	29.29

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	95.5	95% Adjusted Gamma UCL (use when n<50)	97.55

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.856	Mean of logged Data	3.357
Maximum of Logged Data	6.163	SD of logged Data	1.133

Assuming Lognormal Distribution

95% H-UCL	92.52	90% Chebyshev (MVUE) UCL	90.57
95% Chebyshev (MVUE) UCL	107.6	97.5% Chebyshev (MVUE) UCL	131.3
99% Chebyshev (MVUE) UCL	177.9		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	97.53	95% Jackknife UCL	98.54
95% Standard Bootstrap UCL	97.42	95% Bootstrap-t UCL	120.2
95% Hall's Bootstrap UCL	98.79	95% Percentile Bootstrap UCL	99.01
95% BCA Bootstrap UCL	111.1		
90% Chebyshev(Mean, Sd) UCL	124.6	95% Chebyshev(Mean, Sd) UCL	151.7
97.5% Chebyshev(Mean, Sd) UCL	189.3	99% Chebyshev(Mean, Sd) UCL	263.3

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	151.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	32	Number of Distinct Observations	22
		Number of Missing Observations	31
Number of Detects	22	Number of Non-Detects	10
Number of Distinct Detects	18	Number of Distinct Non-Detects	7
Minimum Detect	0.085	Minimum Non-Detect	0.1
Maximum Detect	2.4	Maximum Non-Detect	26.4
Variance Detects	0.278	Percent Non-Detects	31.25%
Mean Detects	0.403	SD Detects	0.527
Median Detects	0.21	CV Detects	1.307
Skewness Detects	3.131	Kurtosis Detects	10.42
Mean of Logged Detects	-1.324	SD of Logged Detects	0.817

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.563	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.313	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.321	KM Standard Error of Mean	0.0864
KM SD	0.462	95% KM (BCA) UCL	0.483
95% KM (t) UCL	0.467	95% KM (Percentile Bootstrap) UCL	0.472
95% KM (z) UCL	0.463	95% KM Bootstrap t UCL	0.73
90% KM Chebyshev UCL	0.58	95% KM Chebyshev UCL	0.697
97.5% KM Chebyshev UCL	0.86	99% KM Chebyshev UCL	1.18

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.515	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.762	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.197	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.189	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.344	k star (bias corrected MLE)	1.191
Theta hat (MLE)	0.3	Theta star (bias corrected MLE)	0.339
nu hat (MLE)	59.12	nu star (bias corrected)	52.39
Mean (detects)	0.403		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.287
Maximum	2.4	Median	0.153
SD	0.468	CV	1.63
k hat (MLE)	0.646	k star (bias corrected MLE)	0.606
Theta hat (MLE)	0.445	Theta star (bias corrected MLE)	0.474
nu hat (MLE)	41.33	nu star (bias corrected)	38.79
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (38.79, α)	25.53	Adjusted Chi Square Value (38.79, β)	24.95
95% Gamma Approximate UCL (use when n>=50)	0.437	95% Gamma Adjusted UCL (use when n<50)	0.447

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.321	SD (KM)	0.462
Variance (KM)	0.213	SE of Mean (KM)	0.0864
k hat (KM)	0.482	k star (KM)	0.457
nu hat (KM)	30.84	nu star (KM)	29.28
theta hat (KM)	0.666	theta star (KM)	0.701
80% gamma percentile (KM)	0.524	90% gamma percentile (KM)	0.883
95% gamma percentile (KM)	1.271	99% gamma percentile (KM)	2.234

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (29.28, α)	17.93	Adjusted Chi Square Value (29.28, β)	17.45
95% Gamma Approximate KM-UCL (use when n>=50)	0.524	95% Gamma Adjusted KM-UCL (use when n<50)	0.538

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.137	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.304	Mean in Log Scale	-1.718
SD in Original Scale	0.46	SD in Log Scale	0.942
95% t UCL (assumes normality of ROS data)	0.442	95% Percentile Bootstrap UCL	0.452
95% BCA Bootstrap UCL	0.5	95% Bootstrap t UCL	0.715
95% H-UCL (Log ROS)	0.417		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.608	KM Geo Mean	0.2
KM SD (logged)	0.835	95% Critical H Value (KM-Log)	2.246
KM Standard Error of Mean (logged)	0.157	95% H-UCL (KM -Log)	0.398
KM SD (logged)	0.835	95% Critical H Value (KM-Log)	2.246
KM Standard Error of Mean (logged)	0.157		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.793	Mean in Log Scale	-1.488
SD in Original Scale	2.351	SD in Log Scale	1.281
95% t UCL (Assumes normality)	1.498	95% H-Stat UCL	0.974

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.398

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	32	Number of Distinct Observations	27
		Number of Missing Observations	32
Minimum	8.6	Mean	22.13
Maximum	51.8	Median	19.5
SD	9.546	Std. Error of Mean	1.688
Coefficient of Variation	0.431	Skewness	1.243

Normal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	24.99	95% Adjusted-CLT UCL (Chen-1995)	25.3
		95% Modified-t UCL (Johnson-1978)	25.05

Gamma GOF Test

A-D Test Statistic	0.274	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.103	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.156	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.243	k star (bias corrected MLE)	5.678
Theta hat (MLE)	3.544	Theta star (bias corrected MLE)	3.897
nu hat (MLE)	399.5	nu star (bias corrected)	363.4
MLE Mean (bias corrected)	22.13	MLE Sd (bias corrected)	9.286
		Approximate Chi Square Value (0.05)	320.2
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	318.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	25.11	95% Adjusted Gamma UCL (use when n<50)	25.28

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.99	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.076	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.152	Mean of logged Data	3.015
Maximum of Logged Data	3.947	SD of logged Data	0.409

Assuming Lognormal Distribution

95% H-UCL	25.41	90% Chebyshev (MVUE) UCL	27.03
95% Chebyshev (MVUE) UCL	29.27	97.5% Chebyshev (MVUE) UCL	32.38
99% Chebyshev (MVUE) UCL	38.48		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	24.9	95% Jackknife UCL	24.99
95% Standard Bootstrap UCL	24.88	95% Bootstrap-t UCL	25.58
95% Hall's Bootstrap UCL	25.43	95% Percentile Bootstrap UCL	25
95% BCA Bootstrap UCL	25.29		
90% Chebyshev(Mean, Sd) UCL	27.19	95% Chebyshev(Mean, Sd) UCL	29.48
97.5% Chebyshev(Mean, Sd) UCL	32.67	99% Chebyshev(Mean, Sd) UCL	38.92

Suggested UCL to Use

95% Student's-t UCL	24.99

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	32	Number of Distinct Observations	31
		Number of Missing Observations	32
Minimum	23	Mean	1423
Maximum	21900	Median	140
SD	4021	Std. Error of Mean	710.9
Coefficient of Variation	2.826	Skewness	4.625

Normal GOF Test

Shapiro Wilk Test Statistic	0.384	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.393	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2628	95% Adjusted-CLT UCL (Chen-1995)	3213
		95% Modified-t UCL (Johnson-1978)	2725

Gamma GOF Test

A-D Test Statistic	2.638	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.838	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.223	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.167	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.375	k star (bias corrected MLE)	0.361
Theta hat (MLE)	3791	Theta star (bias corrected MLE)	3942
nu hat (MLE)	24.02	nu star (bias corrected)	23.1
MLE Mean (bias corrected)	1423	MLE Sd (bias corrected)	2368
		Approximate Chi Square Value (0.05)	13.17
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	12.76

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2496	95% Adjusted Gamma UCL (use when n<50)	2575

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.135	Mean of logged Data	5.489
Maximum of Logged Data	9.994	SD of logged Data	1.757

Assuming Lognormal Distribution

95% H-UCL	3375	90% Chebyshev (MVUE) UCL	2264
95% Chebyshev (MVUE) UCL	2830	97.5% Chebyshev (MVUE) UCL	3616
99% Chebyshev (MVUE) UCL	5159		

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	2592	95% Jackknife UCL	2628
95% Standard Bootstrap UCL	2597	95% Bootstrap-t UCL	5597
95% Hall's Bootstrap UCL	6332	95% Percentile Bootstrap UCL	2688
95% BCA Bootstrap UCL	3433		
90% Chebyshev(Mean, Sd) UCL	3556	95% Chebyshev(Mean, Sd) UCL	4522
97.5% Chebyshev(Mean, Sd) UCL	5862	99% Chebyshev(Mean, Sd) UCL	8496

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	4522

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	33	Number of Distinct Observations	21
		Number of Missing Observations	32
Number of Detects	1	Number of Non-Detects	32
Number of Distinct Detects	1	Number of Distinct Non-Detects	20

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1248 (PCB-1248) was not processed!

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	33	Number of Distinct Observations	25
		Number of Missing Observations	32
Number of Detects	15	Number of Non-Detects	18
Number of Distinct Detects	14	Number of Distinct Non-Detects	11
Minimum Detect	41	Minimum Non-Detect	15
Maximum Detect	1700	Maximum Non-Detect	1800
Variance Detects	242715	Percent Non-Detects	54.55%
Mean Detects	346	SD Detects	492.7
Median Detects	130	CV Detects	1.424
Skewness Detects	2.034	Kurtosis Detects	3.614
Mean of Logged Detects	5.063	SD of Logged Detects	1.249

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.674	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.326	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	170.2	KM Standard Error of Mean	66.85
KM SD	365.3	95% KM (BCA) UCL	301.5
95% KM (t) UCL	283.4	95% KM (Percentile Bootstrap) UCL	290.9
95% KM (z) UCL	280.1	95% KM Bootstrap t UCL	426.9
90% KM Chebyshev UCL	370.7	95% KM Chebyshev UCL	461.6
97.5% KM Chebyshev UCL	587.7	99% KM Chebyshev UCL	835.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.996	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.775	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.23	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.762	k star (bias corrected MLE)	0.654
Theta hat (MLE)	454.1	Theta star (bias corrected MLE)	529.1
nu hat (MLE)	22.86	nu star (bias corrected)	19.62
Mean (detects)	346		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	157.3
Maximum	1700	Median	0.01
SD	369.9	CV	2.351
k hat (MLE)	0.146	k star (bias corrected MLE)	0.153
Theta hat (MLE)	1074	Theta star (bias corrected MLE)	1026
nu hat (MLE)	9.662	nu star (bias corrected)	10.12
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (10.12, α)	4.015	Adjusted Chi Square Value (10.12, β)	3.818
95% Gamma Approximate UCL (use when n>=50)	396.4	95% Gamma Adjusted UCL (use when n<50)	416.8

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	170.2	SD (KM)	365.3
Variance (KM)	133477	SE of Mean (KM)	66.85
k hat (KM)	0.217	k star (KM)	0.217
nu hat (KM)	14.32	nu star (KM)	14.35
theta hat (KM)	784.4	theta star (KM)	782.6
80% gamma percentile (KM)	233.6	90% gamma percentile (KM)	514.3
95% gamma percentile (KM)	857.4	99% gamma percentile (KM)	1790

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (14.35, α)	6.812	Adjusted Chi Square Value (14.35, β)	6.545
95% Gamma Approximate KM-UCL (use when n>=50)	358.5	95% Gamma Adjusted KM-UCL (use when n<50)	373.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	160.9	Mean in Log Scale	3.194
SD in Original Scale	368.3	SD in Log Scale	1.992
95% t UCL (assumes normality of ROS data)	269.5	95% Percentile Bootstrap UCL	274
95% BCA Bootstrap UCL	308.6	95% Bootstrap t UCL	420.7
95% H-UCL (Log ROS)	685.8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.812	KM Geo Mean	45.23
KM SD (logged)	1.436	95% Critical H Value (KM-Log)	3.014
KM Standard Error of Mean (logged)	0.263	95% H-UCL (KM -Log)	272.8
KM SD (logged)	1.436	95% Critical H Value (KM-Log)	3.014
KM Standard Error of Mean (logged)	0.263		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	192.9	Mean in Log Scale	3.922
SD in Original Scale	386.5	SD in Log Scale	1.528
95% t UCL (Assumes normality)	306.9	95% H-Stat UCL	379.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	373.1

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260)

General Statistics

Total Number of Observations	33	Number of Distinct Observations	21
		Number of Missing Observations	32
Number of Detects	6	Number of Non-Detects	27
Number of Distinct Detects	6	Number of Distinct Non-Detects	16
Minimum Detect	23	Minimum Non-Detect	20
Maximum Detect	1300	Maximum Non-Detect	365.5
Variance Detects	228751	Percent Non-Detects	81.82%
Mean Detects	397.8	SD Detects	478.3
Median Detects	255	CV Detects	1.202
Skewness Detects	1.725	Kurtosis Detects	3.126
Mean of Logged Detects	5.193	SD of Logged Detects	1.568

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.809	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	89.97	KM Standard Error of Mean	45.11
KM SD	236.3	95% KM (BCA) UCL	176.4
95% KM (t) UCL	166.4	95% KM (Percentile Bootstrap) UCL	166
95% KM (z) UCL	164.2	95% KM Bootstrap t UCL	250.4
90% KM Chebyshev UCL	225.3	95% KM Chebyshev UCL	286.6
97.5% KM Chebyshev UCL	371.7	99% KM Chebyshev UCL	538.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.258	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.2	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.343	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.754	k star (bias corrected MLE)	0.488
Theta hat (MLE)	527.4	Theta star (bias corrected MLE)	814.7
nu hat (MLE)	9.053	nu star (bias corrected)	5.86
Mean (detects)	397.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	72.34
Maximum	1300	Median	0.01
SD	245	CV	3.387
k hat (MLE)	0.113	k star (bias corrected MLE)	0.123
Theta hat (MLE)	642.6	Theta star (bias corrected MLE)	590.4
nu hat (MLE)	7.43	nu star (bias corrected)	8.088
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (8.09, α)	2.786	Adjusted Chi Square Value (8.09, β)	2.628
95% Gamma Approximate UCL (use when n>=50)	210	95% Gamma Adjusted UCL (use when n<50)	222.7

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	89.97	SD (KM)	236.3
Variance (KM)	55840	SE of Mean (KM)	45.11
k hat (KM)	0.145	k star (KM)	0.152
nu hat (KM)	9.567	nu star (KM)	10.03
theta hat (KM)	620.7	theta star (KM)	592
80% gamma percentile (KM)	98.98	90% gamma percentile (KM)	267.2
95% gamma percentile (KM)	493.9	99% gamma percentile (KM)	1150

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.03, α)	3.961	Adjusted Chi Square Value (10.03, β)	3.766
95% Gamma Approximate KM-UCL (use when n>=50)	227.8	95% Gamma Adjusted KM-UCL (use when n<50)	239.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	74.55	Mean in Log Scale	1.297
SD in Original Scale	244.3	SD in Log Scale	2.22
95% t UCL (assumes normality of ROS data)	146.6	95% Percentile Bootstrap UCL	152.9
95% BCA Bootstrap UCL	206.6	95% Bootstrap t UCL	323
95% H-UCL (Log ROS)	223.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.434	KM Geo Mean	31
KM SD (logged)	1.04	95% Critical H Value (KM-Log)	2.487
KM Standard Error of Mean (logged)	0.202	95% H-UCL (KM -Log)	84.14
KM SD (logged)	1.04	95% Critical H Value (KM-Log)	2.487
KM Standard Error of Mean (logged)	0.202		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	90.95	Mean in Log Scale	3.278
SD in Original Scale	241.2	SD in Log Scale	1.217
95% t UCL (Assumes normality)	162.1	95% H-Stat UCL	99.73

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	166.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin

General Statistics

Total Number of Observations	32	Number of Distinct Observations	27
		Number of Missing Observations	31
Number of Detects	6	Number of Non-Detects	26
Number of Distinct Detects	6	Number of Distinct Non-Detects	21
Minimum Detect	7.2	Minimum Non-Detect	1
Maximum Detect	65	Maximum Non-Detect	180
Variance Detects	468.1	Percent Non-Detects	81.25%
Mean Detects	24.37	SD Detects	21.64
Median Detects	16	CV Detects	0.888
Skewness Detects	1.717	Kurtosis Detects	2.921
Mean of Logged Detects	2.91	SD of Logged Detects	0.8

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.808	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.247	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	6.689	KM Standard Error of Mean	2.902
KM SD	13.51	95% KM (BCA) UCL	11.94
95% KM (t) UCL	11.61	95% KM (Percentile Bootstrap) UCL	11.59
95% KM (z) UCL	11.46	95% KM Bootstrap t UCL	13.03
90% KM Chebyshev UCL	15.39	95% KM Chebyshev UCL	19.34
97.5% KM Chebyshev UCL	24.81	99% KM Chebyshev UCL	35.56

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.333	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.705	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.233	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.336	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.916	k star (bias corrected MLE)	1.069
Theta hat (MLE)	12.72	Theta star (bias corrected MLE)	22.79
nu hat (MLE)	23	nu star (bias corrected)	12.83
Mean (detects)	24.37		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4.577
Maximum	65	Median	0.01
SD	12.99	CV	2.839
k hat (MLE)	0.161	k star (bias corrected MLE)	0.167
Theta hat (MLE)	28.39	Theta star (bias corrected MLE)	27.42
nu hat (MLE)	10.32	nu star (bias corrected)	10.68
Adjusted Level of Significance (β)	0.0416		
Approximate Chi Square Value (10.68, α)	4.374	Adjusted Chi Square Value (10.68, β)	4.159
95% Gamma Approximate UCL (use when n>=50)	11.18	95% Gamma Adjusted UCL (use when n<50)	11.76

Table B.15.4

Summary of ProUCL Output for EU017 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/8/2019 9:47:44 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	6.689	SD (KM)	13.51
Variance (KM)	182.5	SE of Mean (KM)	2.902
k hat (KM)	0.245	k star (KM)	0.243
nu hat (KM)	15.69	nu star (KM)	15.55
theta hat (KM)	27.29	theta star (KM)	27.53
80% gamma percentile (KM)	9.614	90% gamma percentile (KM)	20.11
95% gamma percentile (KM)	32.65	99% gamma percentile (KM)	66.16

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.55, α)	7.645	Adjusted Chi Square Value (15.55, β)	7.348
95% Gamma Approximate KM-UCL (use when n>=50)	13.6	95% Gamma Adjusted KM-UCL (use when n<50)	14.15

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	6.045	Mean in Log Scale	0.953
SD in Original Scale	12.49	SD in Log Scale	1.087
95% t UCL (assumes normality of ROS data)	9.789	95% Percentile Bootstrap UCL	9.935
95% BCA Bootstrap UCL	11.68	95% Bootstrap t UCL	16.58
95% H-UCL (Log ROS)	7.688		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.759	KM Geo Mean	2.137
KM SD (logged)	1.301	95% Critical H Value (KM-Log)	2.816
KM Standard Error of Mean (logged)	0.298	95% H-UCL (KM -Log)	9.619
KM SD (logged)	1.301	95% Critical H Value (KM-Log)	2.816
KM Standard Error of Mean (logged)	0.298		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	17.26	Mean in Log Scale	1.697
SD in Original Scale	24.06	SD in Log Scale	1.716
95% t UCL (Assumes normality)	24.47	95% H-Stat UCL	67.91

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	11.61

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.1

Summary of ProUCL Input Data for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	4	5	6	7	8	9	10	11	12	13	14	15
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene
on-site (EU18)	S2(EPA)	10/23/1990	0-1 ft BGS			74	1	140	1	280	1			330	0	330	0
on-site (EU18)	S03(OEPA)	7/9/1996	1.5-2 ft BGS	12	0	410	0	410	0	410	0	410	0	410	0	410	0
on-site (EU18)	SS-26	10/26/2018	0-2 ft BGS			1500	1	1500	1	2600	1	77	1	410	1	1300	1
on-site (EU18)	SS-27	10/26/2018	0-2 ft BGS	0.72	0	11	1	10	0	12	1	21	0	7.7	0	8.2	0
on-site (EU18)	SS-28	10/26/2018	0-2 ft BGS	0.74	0	11	1	14	1	18	1	24	0	8.6	0	9.2	0
on-site (EU18)	SS-33	10/26/2018	0.17-2.17 ft BGS	1.3	0	6900	1	6000	1	8500	1	870	1	1200	1	3800	1
on-site (EU18)	SS-34	10/26/2018	0-2 ft BGS	1.8	0	260	1	220	1	330	1	52	1	58	1	160	1
on-site (EU18)	SS-105	10/26/2018	0-2 ft BGS														
on-site (EU18)	SS-179-AS	10/26/2018	0-0.5 ft BGS														
on-site (EU18)	SS-180-AS	10/26/2018	0.17-0.67 ft BGS														
on-site (EU19)	BH75-13	6/25/2013	0-2 ft BGS	560	1												
on-site (EU19)	BH166-17	12/19/2017	1-3 ft BGS														
on-site (EU19)	S1(EPA)	10/23/1990	1-2 ft BGS			310	1	230	1	230	1			330	0	96	1
on-site (EU19)	S3(EPA)	10/23/1990	0-1 ft BGS			8500	1	5700	1	9500	1			1200	1	5000	1
on-site (EU19)	S4(EPA)	10/23/1990	0-1 ft BGS			330	0	330	0	330	0			330	0	330	0
on-site (EU19)	S5(EPA)	10/23/1990	1-2 ft BGS			170	1	150	1	320	1			330	0	150	1
on-site (EU19)	S6(EPA)	10/23/1990	0-1 ft BGS			6900	1	4800	1	7800	1			1600	1	4100	1
on-site (EU19)	S7(EPA)	10/23/1990	0-1 ft BGS			1100	1	1100	1	2900	1			230	1	910	1
on-site (EU19)	S8(EPA)	10/23/1990	0-1 ft BGS			330	0	150	1	230	1			330	0	160	1
on-site (EU19)	S9(EPA)	10/23/1990	0-1 ft BGS			330	0	330	0	150	1			330	0	330	0
on-site (EU19)	S11(EPA)	10/23/1990	0-1 ft BGS			430	1	220	1	630	1			330	0	270	1
on-site (EU19)	S02(OEPA)	7/9/1996	0-0.1 ft BGS	10	0	340	0	340	0	340	0	340	0	340	0	340	0
on-site (EU19)	S04(OEPA)	7/9/1996	1.5-2 ft BGS	16	0	41	1	520	0	520	0	520	0	520	0	520	0
on-site (EU19)	S06(OEPA)	7/9/1996	1.5-2.5 ft BGS	16	0	530	0	530	0	530	0	530	0	530	0	530	0
on-site (EU19)	S09(OEPA)	7/9/1996	0.3-0.5 ft BGS	11	0	180	1	110	1	320	1	350	0	350	0	120	1
on-site (EU19)	S10(OEPA)	7/9/1996	0-0.3 ft BGS	12	0	51	1	400	0	79	1	400	0	400	0	400	0
on-site (EU19)	S11(OEPA)	7/9/1996	0.2-0.3 ft BGS	11	0	950	1	1000	1	1300	1	38	1	450	1	910	1
on-site (EU19)	SS-20	10/31/2017	0-2 ft BGS			200	1	140	1	330	1	79	0	1.9	0	58	1
on-site (EU19)	SS-21	11/19/2018	0-2 ft BGS	1.1	0	480	1	470	1	960	1	59	1	94	1	260	1
on-site (EU19)	SS-22	11/7/2017	0-2 ft BGS	0.61	0	170	1	140	1	220	1	180	0	4.3	0	95	1
on-site (EU19)	SS-23	11/19/2018	0-2 ft BGS	0.94	0	260	1	230	1	400	1	36	1	50	1	140	1
on-site (EU19)	SS-24	11/7/2017	0-2 ft BGS	0.83	0	850	1	1000	1	1500	1	130	0	210	1	690	1
on-site (EU19)	SS-29	10/31/2017	0-2 ft BGS	0.91	0	120	1	110	1	240	1	38	0	0.93	0	47	1
on-site (EU19)	SS-30	11/2/2017	0-2 ft BGS	0.36	0	220	1	210	1	350	1	31	0	0.77	0	110	1
on-site (EU19)	SS-31	11/2/2017	0-2 ft BGS	0.49	0	23	1	23	1	33	1	30	0	0.74	0	18	1
on-site (EU19)	SS-35	10/30/2017	0-2 ft BGS	0.39	0	430	1	530	1	560	1	30	1	110	1	390	1
on-site (EU19)	SS-36	10/31/2017	0-2 ft BGS	0.44	0	160	1	180	1	340	1	29	0	0.72	0	79	1
on-site (EU19)	SS-106	11/19/2018	0-2 ft BGS														
on-site (EU19)	SS-107	11/19/2018	0-2 ft BGS														
on-site (EU19)	SS-108 (SS-22/TT-32)	11/16/2018	0-2 ft BGS														
on-site (EU19)	SS-110 (SS-31/TT39)	11/19/2018	0-2 ft BGS														
on-site (EU19)	SS-111 (SS-30/TT-38)	11/16/2018	0-2 ft BGS														
on-site (EU19)	SS-113 (SS-35/TP-15)	11/16/2018	0-2 ft BGS														
on-site (EU19)	SS-181-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-182-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-183-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-184-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-185-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-186-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-187-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-188-AS	10/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-189-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-190-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-191-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-192-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	TP-2	9/24/2008	1 ft BGS	4.8	0							55	0	7.3	0		
on-site (EU19)	TP-2	9/24/2008	1 ft BGS			33	1	35	1	46	1					20	1

Table B.16.1

Summary of ProUCL Input Data for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				16	17	18	19	20	21	24	25	26	27	28	29	30	31	32	33	34	35	36	37
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead
on-site (EU18)	S2(EPA)	10/23/1990	0-1 ft BGS	3800	1	2.4	0	6.8	1	1	0	2.4	1	10	0	48.9	1			18000	1	43	1
on-site (EU18)	S03(OEPA)	7/9/1996	1.5-2 ft BGS	1525	1	0.82	0	1.6	1	0.43	1	1.85	1	1.7	1	116.45	1	0.205	0	10050	1	11.3	1
on-site (EU18)	SS-26	10/26/2018	0-2 ft BGS	7500	1	1.6	1	41	1	0.76	1	0.91	1	16	1	85	1	0.54	1	9700	1	84	1
on-site (EU18)	SS-27	10/26/2018	0-2 ft BGS	1200	1	0.57	1	3.8	1	0.13	1	0.56	1	4.3	1	88	1	0.23	0	47000	1	6.4	1
on-site (EU18)	SS-28	10/26/2018	0-2 ft BGS	1500	1	0.21	1	3	1	1.2	1	0.3	0	2.1	1	34	1	0.24	0	27000	1	26	1
on-site (EU18)	SS-33	10/26/2018	0.17-2.17 ft BGS	6600	1	3.4	1	17	1	1.1	1	0.36	0	8.9	1	210	1	0.31	1	13000	1	170	1
on-site (EU18)	SS-34	10/26/2018	0-2 ft BGS	7600	1	1.4	1	28	1	0.68	1	2.5	0	9.7	1	81	1	0.94	1	17000	1	110	1
on-site (EU18)	SS-105	10/26/2018	0-2 ft BGS																				
on-site (EU18)	SS-179-AS	10/26/2018	0-0.5 ft BGS																				
on-site (EU18)	SS-180-AS	10/26/2018	0.17-0.67 ft BGS																				
on-site (EU19)	BH75-13	6/25/2013	0-2 ft BGS																				
on-site (EU19)	BH166-17	12/19/2017	1-3 ft BGS									0.28	0										
on-site (EU19)	S1(EPA)	10/23/1990	1-2 ft BGS	5730	1	2.4	0	23.9	1	1.3	1	2.6	1	3.7	1	66.8	1			15900	1	64.1	1
on-site (EU19)	S3(EPA)	10/23/1990	0-1 ft BGS	4740	1	31.6	1	8.3	1	14	1	13.1	1	5.6	1	2220	1			77000	1	3300	1
on-site (EU19)	S4(EPA)	10/23/1990	0-1 ft BGS	3360	1	2.4	0	12.6	1	1	0	0.9	1	8.8	1	56.7	1			2840	1	10.4	1
on-site (EU19)	S5(EPA)	10/23/1990	1-2 ft BGS	1990	1	2.4	0	10.3	1	1	1	1.6	1	5	1	74.1	1			4230	1	59.3	1
on-site (EU19)	S6(EPA)	10/23/1990	0-1 ft BGS	4620	1	2.4	0	11.1	1	1	0	1.2	1	8.2	1	47.4	1			5630	1	15.9	1
on-site (EU19)	S7(EPA)	10/23/1990	0-1 ft BGS	2970	1	13.2	1	8.9	1	5.9	1	2.9	1	5.2	1	316	1			14800	1	474	1
on-site (EU19)	S8(EPA)	10/23/1990	0-1 ft BGS	5350	1	2.4	0	11.6	1	8.6	1	6.1	1	6.2	1	2200	1			48300	1	1590	1
on-site (EU19)	S9(EPA)	10/23/1990	0-1 ft BGS	11100	1	2.1	1	69.3	1	1	0	3.3	1	22.1	1	76.6	1			11100	1	49.7	1
on-site (EU19)	S11(EPA)	10/23/1990	0-1 ft BGS	8460	1	18.2	1	20.1	1	8.4	1	4.3	1	10.9	1	796	1			25500	1	811	1
on-site (EU19)	S02(OEPA)	7/9/1996	0-0.1 ft BGS	10400	1	0.7	1	77.2	1	6.6	1	3.4	1	16.2	1	91.8	1	0.26	1	9430	1	110	1
on-site (EU19)	S04(OEPA)	7/9/1996	1.5-2 ft BGS	5290	1	1	1	27	1	0.38	1	2	1	9.6	1	73	1	0.34	1	5890	1	97	1
on-site (EU19)	S06(OEPA)	7/9/1996	1.5-2.5 ft BGS	6210	1	1	0	49.7	1	0.33	0	2.4	1	8.7	1	41.5	1	0.29	1	3120	1	18.2	1
on-site (EU19)	S09(OEPA)	7/9/1996	0.3-0.5 ft BGS	4970	1	2.9	1	36	1	3.9	1	7.2	1	11.2	1	1680	1	3.7	1	13800	1	1990	1
on-site (EU19)	S10(OEPA)	7/9/1996	0-0.3 ft BGS	8080	1	8.4	1	15.4	1	16.3	1	6.2	1	13.8	1	191000	1	0.6	1	92300	1	12100	1
on-site (EU19)	S11(OEPA)	7/9/1996	0.2-0.3 ft BGS	3290	1	2.1	1	6.6	1	1.4	1	2.7	1	4.3	1	405	1	0.55	1	16000	1	242	1
on-site (EU19)	SS-20	10/31/2017	0-2 ft BGS	4700	1	21	1	60	1	5.3	1	3.4	1	12	1	580	1	0.68	0	9200	1	370	1
on-site (EU19)	SS-21	11/19/2018	0-2 ft BGS	4500	1	2.2	1	11	1	3.5	1	1.5	0	3.9	1	320	1	0.35	1	7900	1	210	1
on-site (EU19)	SS-22	11/7/2017	0-2 ft BGS	12000	1	52	1	15	1	34	1	15.7	1	17	1	3200	1	0.59	0	94000	1	13000	1
on-site (EU19)	SS-23	11/19/2018	0-2 ft BGS	3900	1	30	1	10	1	2.2	1	0.6	0	7.3	1	320	1	0.24	0	19000	1	360	1
on-site (EU19)	SS-24	11/7/2017	0-2 ft BGS	7600	1	39	1	10	1	8	1	5	1	7.7	1	750	1	0.51	0	32000	1	1900	1
on-site (EU19)	SS-29	10/31/2017	0-2 ft BGS	2800	1	0.68	1	4	1	0.34	1	1.1	1	4.3	1	37	1	0.6	0	5900	1	46	1
on-site (EU19)	SS-30	11/2/2017	0-2 ft BGS	7800	1	0.25	0	8	1	0.27	1	1.9	1	6.4	1	19	1	0.53	0	16000	1	17	1
on-site (EU19)	SS-31	11/2/2017	0-2 ft BGS	4700	1	0.17	0	4.4	1	0.17	0	1.2	1	3.6	1	17	1	0.52	0	8900	1	53	1
on-site (EU19)	SS-35	10/30/2017	0-2 ft BGS	7700	1	0.41	1	8.3	1	0.44	1	2	1	7.2	1	44	1	0.47	0	15000	1	120	1
on-site (EU19)	SS-36	10/31/2017	0-2 ft BGS	3400	1	0.24	1	5.4	1	0.25	1	0.9	1	2.9	1	75	1	0.48	0	8200	1	42	1
on-site (EU19)	SS-106	11/19/2018	0-2 ft BGS																				
on-site (EU19)	SS-107	11/19/2018	0-2 ft BGS																				
on-site (EU19)	SS-108 (SS-22/TT-32)	11/16/2018	0-2 ft BGS																				
on-site (EU19)	SS-110 (SS-31/TT39)	11/19/2018	0-2 ft BGS																				
on-site (EU19)	SS-111 (SS-30/TT-38)	11/16/2018	0-2 ft BGS																				
on-site (EU19)	SS-113 (SS-35/TP-15)	11/16/2018	0-2 ft BGS																				
on-site (EU19)	SS-181-AS	11/19/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-182-AS	11/19/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-183-AS	11/16/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-184-AS	11/16/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-185-AS	11/16/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-186-AS	11/19/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-187-AS	11/16/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-188-AS	10/16/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-189-AS	11/16/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-190-AS	11/19/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-191-AS	11/16/2018	0-0.5 ft BGS																				
on-site (EU19)	SS-192-AS	11/16/2018	0-0.5 ft BGS																				
on-site (EU19)	TP-2	9/24/2008	1 ft BGS			6.6	0											0.55	0				
on-site (EU19)	TP-2	9/24/2008	1 ft BGS	6250	1			8.3	1	0.29	1	1.4	1	5.1	1	15.8	1			13500	1	17.3	1

Table B.16.1

Summary of ProUCL Input Data for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				38	39	40	41	42	43	44	45	48	49	50	51	52	53
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Lead - coarse fraction	D_Lead - coarse fraction	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)	Manganese	D_Manganese	Nickel	D_Nickel	Thallium	D_Thallium	Vanadium	D_Vanadium
on-site (EU18)	S2(EPA)	10/23/1990	0-1 ft BGS							344	1	13.9	1	2	0	7.3	1
on-site (EU18)	S03(OEPA)	7/9/1996	1.5-2 ft BGS							346	1	15	1	1.7	1	0.91	1
on-site (EU18)	SS-26	10/26/2018	0-2 ft BGS							120	1	30	1	2.4	1	60	1
on-site (EU18)	SS-27	10/26/2018	0-2 ft BGS							510	1	51	1	0.039	0	2.7	1
on-site (EU18)	SS-28	10/26/2018	0-2 ft BGS	48	1	260	1	84	1	1400	1	22	1	0.054	0	2	1
on-site (EU18)	SS-33	10/26/2018	0.17-2.17 ft BGS	200	1	290	1	220	1	200	1	30	1	0.89	1	27	1
on-site (EU18)	SS-34	10/26/2018	0-2 ft BGS							130	1	42	1	1	1	29	1
on-site (EU18)	SS-105	10/26/2018	0-2 ft BGS														
on-site (EU18)	SS-179-AS	10/26/2018	0-0.5 ft BGS														
on-site (EU18)	SS-180-AS	10/26/2018	0.17-0.67 ft BGS														
on-site (EU19)	BH75-13	6/25/2013	0-2 ft BGS														
on-site (EU19)	BH166-17	12/19/2017	1-3 ft BGS														
on-site (EU19)	S1(EPA)	10/23/1990	1-2 ft BGS							309	1	28.9	1	2	0	18.2	1
on-site (EU19)	S3(EPA)	10/23/1990	0-1 ft BGS							437	1	262	1	2	0	33.9	1
on-site (EU19)	S4(EPA)	10/23/1990	0-1 ft BGS							7.2	1	13.6	1	2	0	27.9	1
on-site (EU19)	S5(EPA)	10/23/1990	1-2 ft BGS							55.2	1	17.2	1	2	0	11.5	1
on-site (EU19)	S6(EPA)	10/23/1990	0-1 ft BGS							27	1	17.2	1	2	0	28.1	1
on-site (EU19)	S7(EPA)	10/23/1990	0-1 ft BGS							130	1	94.7	1	2	0	16	1
on-site (EU19)	S8(EPA)	10/23/1990	0-1 ft BGS							272	1	402	1	2	0	27.4	1
on-site (EU19)	S9(EPA)	10/23/1990	0-1 ft BGS							162	1	56.6	1	2	1	69.6	1
on-site (EU19)	S11(EPA)	10/23/1990	0-1 ft BGS							294	1	65.5	1	0.73	1	35.5	1
on-site (EU19)	S02(OEPA)	7/9/1996	0-0.1 ft BGS							99.1	1	34.6	1	1.8	1	92.6	1
on-site (EU19)	S04(OEPA)	7/9/1996	1.5-2 ft BGS							72.8	1	20	1	1.7	1	47.7	1
on-site (EU19)	S06(OEPA)	7/9/1996	1.5-2.5 ft BGS							45.2	1	16.6	1	1.3	0	61.9	1
on-site (EU19)	S09(OEPA)	7/9/1996	0.3-0.5 ft BGS							236	1	85	1	1.5	1	33.6	1
on-site (EU19)	S10(OEPA)	7/9/1996	0-0.3 ft BGS							693	1	139	1	4.5	1	28.1	1
on-site (EU19)	S11(OEPA)	7/9/1996	0.2-0.3 ft BGS							344	1	24.2	1	1.3	1	15.6	1
on-site (EU19)	SS-20	10/31/2017	0-2 ft BGS							47	1	38	1	1.8	1	44	1
on-site (EU19)	SS-21	11/19/2018	0-2 ft BGS							76	1	36	1	0.13	1	9.1	1
on-site (EU19)	SS-22	11/7/2017	0-2 ft BGS	6400	1	4200	1	5900	1	600	1	120	1	0.41	1	29	1
on-site (EU19)	SS-23	11/19/2018	0-2 ft BGS	240	1	360	1	260	1	270	1	170	1	0.3	1	21	1
on-site (EU19)	SS-24	11/7/2017	0-2 ft BGS							530	1	94	1	0.2	1	21	1
on-site (EU19)	SS-29	10/31/2017	0-2 ft BGS							100	1	11	1	0.13	1	12	1
on-site (EU19)	SS-30	11/2/2017	0-2 ft BGS							480	1	15	1	0.19	1	20	1
on-site (EU19)	SS-31	11/2/2017	0-2 ft BGS	59	1	120	1	70	1	360	1	9.7	1	0.12	1	13	1
on-site (EU19)	SS-35	10/30/2017	0-2 ft BGS							620	1	14	1	0.18	1	21	1
on-site (EU19)	SS-36	10/31/2017	0-2 ft BGS							260	1	7.3	1	0.1	1	11	1
on-site (EU19)	SS-106	11/19/2018	0-2 ft BGS														
on-site (EU19)	SS-107	11/19/2018	0-2 ft BGS														
on-site (EU19)	SS-108 (SS-22/TT-32)	11/16/2018	0-2 ft BGS														
on-site (EU19)	SS-110 (SS-31/TT39)	11/19/2018	0-2 ft BGS														
on-site (EU19)	SS-111 (SS-30/TT-38)	11/16/2018	0-2 ft BGS														
on-site (EU19)	SS-113 (SS-35/TP-15)	11/16/2018	0-2 ft BGS														
on-site (EU19)	SS-181-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-182-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-183-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-184-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-185-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-186-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-187-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-188-AS	10/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-189-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-190-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-191-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-192-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	TP-2	9/24/2008	1 ft BGS														
on-site (EU19)	TP-2	9/24/2008	1 ft BGS							445	1	11.8	1	0.17	1	17.1	1

Table B.16.1

Summary of ProUCL Input Data for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				54	55	56	57	58	59	60	61	62	63	66	67
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Zinc	D_Zinc	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Aroclor-1260 (PCB-1260)	D_Aroclor-1260 (PCB-1260)	Chrysotile asbestos	D_Chrysotile asbestos
on-site (EU18)	S2(EPA)	10/23/1990	0-1 ft BGS	550	1			4200	1			2800	1		
on-site (EU18)	S03(OEPA)	7/9/1996	1.5-2 ft BGS	32	1	41	0	41	0	41	0	41	0		
on-site (EU18)	SS-26	10/26/2018	0-2 ft BGS	160	1	34	0	43	0	42	0	200	1		
on-site (EU18)	SS-27	10/26/2018	0-2 ft BGS	18	1	21	0	26	0	25	0	24	0		
on-site (EU18)	SS-28	10/26/2018	0-2 ft BGS	66	1	23	0	30	0	28	0	27	0		
on-site (EU18)	SS-33	10/26/2018	0.17-2.17 ft BGS	220	1	28	0	35	0	130	1	32	0		
on-site (EU18)	SS-34	10/26/2018	0-2 ft BGS	160	1	39	0	49	0	240	1	45	0		
on-site (EU18)	SS-105	10/26/2018	0-2 ft BGS												
on-site (EU18)	SS-179-AS	10/26/2018	0-0.5 ft BGS												
on-site (EU18)	SS-180-AS	10/26/2018	0.17-0.67 ft BGS											0.25	0
on-site (EU19)	BH75-13	6/25/2013	0-2 ft BGS												
on-site (EU19)	BH166-17	12/19/2017	1-3 ft BGS												
on-site (EU19)	S1(EPA)	10/23/1990	1-2 ft BGS	112	1			360	1			300	1		
on-site (EU19)	S3(EPA)	10/23/1990	0-1 ft BGS	2350	1			80	0			580	1		
on-site (EU19)	S4(EPA)	10/23/1990	0-1 ft BGS	9.2	1			80	0			160	0		
on-site (EU19)	S5(EPA)	10/23/1990	1-2 ft BGS	57.6	1			540	1			110	1		
on-site (EU19)	S6(EPA)	10/23/1990	0-1 ft BGS	14.4	1			80	0			160	0		
on-site (EU19)	S7(EPA)	10/23/1990	0-1 ft BGS	2210	1			80	0			1400	1		
on-site (EU19)	S8(EPA)	10/23/1990	0-1 ft BGS	1490	1			80	0			160	0		
on-site (EU19)	S9(EPA)	10/23/1990	0-1 ft BGS	75.1	1			80	0			160	0		
on-site (EU19)	S11(EPA)	10/23/1990	0-1 ft BGS	480	1			80	0			460	1		
on-site (EU19)	S02(OEPA)	7/9/1996	0-0.1 ft BGS	39.4	1	34	0	34	0	34	0	34	0		
on-site (EU19)	S04(OEPA)	7/9/1996	1.5-2 ft BGS	231	1	52	0	52	0	52	0	52	0		
on-site (EU19)	S06(OEPA)	7/9/1996	1.5-2.5 ft BGS	48	1	53	0	53	0	53	0	53	0		
on-site (EU19)	S09(OEPA)	7/9/1996	0.3-0.5 ft BGS	291	1	35	0	35	0	830	1	1200	1		
on-site (EU19)	S10(OEPA)	7/9/1996	0-0.3 ft BGS	11500	1	40	0	40	0	170	1	40	0		
on-site (EU19)	S11(OEPA)	7/9/1996	0.2-0.3 ft BGS	159	1	36	0	36	0	36	0	36	0		
on-site (EU19)	SS-20	10/31/2017	0-2 ft BGS	390	1	29	0	25	0	85	1	26	0		
on-site (EU19)	SS-21	11/19/2018	0-2 ft BGS	810	1	770	1	150	0	1100	1	140	0		
on-site (EU19)	SS-22	11/7/2017	0-2 ft BGS	2800	1	340	1	22	0	660	1	23	0		
on-site (EU19)	SS-23	11/19/2018	0-2 ft BGS	430	1	23	0	30	0	110	1	27	0		
on-site (EU19)	SS-24	11/7/2017	0-2 ft BGS	1200	1	480	0	410	0	29000	1	430	0		
on-site (EU19)	SS-29	10/31/2017	0-2 ft BGS	43	1	28	0	24	0	84	1	25	0		
on-site (EU19)	SS-30	11/2/2017	0-2 ft BGS	58	1	23	0	20	0	28	1	21	0		
on-site (EU19)	SS-31	11/2/2017	0-2 ft BGS	46	1	23	0	19	0	16	0	21	0		
on-site (EU19)	SS-35	10/30/2017	0-2 ft BGS	110	1	23	0	20	0	52	1	21	0		
on-site (EU19)	SS-36	10/31/2017	0-2 ft BGS	86	1	22	0	19	0	75	1	20	0		
on-site (EU19)	SS-106	11/19/2018	0-2 ft BGS												
on-site (EU19)	SS-107	11/19/2018	0-2 ft BGS												
on-site (EU19)	SS-108 (SS-22/TT-32)	11/16/2018	0-2 ft BGS												
on-site (EU19)	SS-110 (SS-31/TT39)	11/19/2018	0-2 ft BGS												
on-site (EU19)	SS-111 (SS-30/TT-38)	11/16/2018	0-2 ft BGS												
on-site (EU19)	SS-113 (SS-35/TP-15)	11/16/2018	0-2 ft BGS												
on-site (EU19)	SS-181-AS	11/19/2018	0-0.5 ft BGS											0.25	1
on-site (EU19)	SS-182-AS	11/19/2018	0-0.5 ft BGS											0.25	0
on-site (EU19)	SS-183-AS	11/16/2018	0-0.5 ft BGS											0.25	0
on-site (EU19)	SS-184-AS	11/16/2018	0-0.5 ft BGS											0.25	0
on-site (EU19)	SS-185-AS	11/16/2018	0-0.5 ft BGS											0.25	1
on-site (EU19)	SS-186-AS	11/19/2018	0-0.5 ft BGS												
on-site (EU19)	SS-187-AS	11/16/2018	0-0.5 ft BGS											0.25	0
on-site (EU19)	SS-188-AS	10/16/2018	0-0.5 ft BGS											0.5	1
on-site (EU19)	SS-189-AS	11/16/2018	0-0.5 ft BGS											0.25	0
on-site (EU19)	SS-190-AS	11/19/2018	0-0.5 ft BGS											0.25	0
on-site (EU19)	SS-191-AS	11/16/2018	0-0.5 ft BGS												
on-site (EU19)	SS-192-AS	11/16/2018	0-0.5 ft BGS											0.25	0
on-site (EU19)	TP-2	9/24/2008	1 ft BGS			36	0	36	0	36	0	23	1		
on-site (EU19)	TP-2	9/24/2008	1 ft BGS	53.7	1										

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	22	Number of Distinct Observations	19
Number of Detects	1	Number of Non-Detects	21
Number of Distinct Detects	1	Number of Distinct Non-Detects	18

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,1-Dichloroethane was not processed!

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	33	Number of Distinct Observations	26
Number of Detects	27	Number of Non-Detects	6
Number of Distinct Detects	22	Number of Distinct Non-Detects	4
Minimum Detect	11	Minimum Non-Detect	330
Maximum Detect	8500	Maximum Non-Detect	530
Variance Detects	5366809	Percent Non-Detects	18.18%
Mean Detects	1123	SD Detects	2317
Median Detects	220	CV Detects	2.062
Skewness Detects	2.57	Kurtosis Detects	5.378
Mean of Logged Detects	5.526	SD of Logged Detects	1.776

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.503	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.356	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	944.9	KM Standard Error of Mean	371.1
KM SD	2091	95% KM (BCA) UCL	1596
95% KM (t) UCL	1573	95% KM (Percentile Bootstrap) UCL	1599
95% KM (z) UCL	1555	95% KM Bootstrap t UCL	1859
90% KM Chebyshev UCL	2058	95% KM Chebyshev UCL	2562
97.5% KM Chebyshev UCL	3262	99% KM Chebyshev UCL	4637

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.699	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.823	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.226	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.179	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.434	k star (bias corrected MLE)	0.41
Theta hat (MLE)	2591	Theta star (bias corrected MLE)	2740
nu hat (MLE)	23.41	nu star (bias corrected)	22.14
Mean (detects)	1123		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	923.7
Maximum	8500	Median	170
SD	2132	CV	2.308
k hat (MLE)	0.249	k star (bias corrected MLE)	0.247
Theta hat (MLE)	3709	Theta star (bias corrected MLE)	3745
nu hat (MLE)	16.44	nu star (bias corrected)	16.28
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (16.28, α)	8.158	Adjusted Chi Square Value (16.28, β)	7.862
95% Gamma Approximate UCL (use when n>=50)	1843	95% Gamma Adjusted UCL (use when n<50)	1912

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	944.9	SD (KM)	2091
Variance (KM)	4373878	SE of Mean (KM)	371.1
k hat (KM)	0.204	k star (KM)	0.206
nu hat (KM)	13.47	nu star (KM)	13.58
theta hat (KM)	4629	theta star (KM)	4592
80% gamma percentile (KM)	1263	90% gamma percentile (KM)	2858
95% gamma percentile (KM)	4832	99% gamma percentile (KM)	10243

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.58, α)	6.285	Adjusted Chi Square Value (13.58, β)	6.03
95% Gamma Approximate KM-UCL (use when n>=50)	2042	95% Gamma Adjusted KM-UCL (use when n<50)	2128

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.923	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.104	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.167	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	940	Mean in Log Scale	5.36
SD in Original Scale	2125	SD in Log Scale	1.656
95% t UCL (assumes normality of ROS data)	1567	95% Percentile Bootstrap UCL	1610
95% BCA Bootstrap UCL	1766	95% Bootstrap t UCL	1847
95% H-UCL (Log ROS)	2222		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.343	KM Geo Mean	209.1
KM SD (logged)	1.688	95% Critical H Value (KM-Log)	3.378
KM Standard Error of Mean (logged)	0.314	95% H-UCL (KM -Log)	2383
KM SD (logged)	1.688	95% Critical H Value (KM-Log)	3.378
KM Standard Error of Mean (logged)	0.314		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	953.6	Mean in Log Scale	5.471
SD in Original Scale	2120	SD in Log Scale	1.607
95% t UCL (Assumes normality)	1579	95% H-Stat UCL	2182

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	2562

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	33	Number of Distinct Observations	24
Number of Detects	25	Number of Non-Detects	8
Number of Distinct Detects	18	Number of Distinct Non-Detects	7
Minimum Detect	14	Minimum Non-Detect	10
Maximum Detect	6000	Maximum Non-Detect	530
Variance Detects	3086773	Percent Non-Detects	24.24%
Mean Detects	976.1	SD Detects	1757
Median Detects	220	CV Detects	1.8
Skewness Detects	2.327	Kurtosis Detects	4.208
Mean of Logged Detects	5.686	SD of Logged Detects	1.569

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.555	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.918	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.32	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.173	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	769.5	KM Standard Error of Mean	274.2
KM SD	1543	95% KM (BCA) UCL	1315
95% KM (t) UCL	1234	95% KM (Percentile Bootstrap) UCL	1247
95% KM (z) UCL	1221	95% KM Bootstrap t UCL	1554
90% KM Chebyshev UCL	1592	95% KM Chebyshev UCL	1965
97.5% KM Chebyshev UCL	2482	99% KM Chebyshev UCL	3498

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.752	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.804	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.28	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.184	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.526	k star (bias corrected MLE)	0.49
Theta hat (MLE)	1854	Theta star (bias corrected MLE)	1992
nu hat (MLE)	26.32	nu star (bias corrected)	24.5
Mean (detects)	976.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	742.4
Maximum	6000	Median	150
SD	1578	CV	2.126
k hat (MLE)	0.229	k star (bias corrected MLE)	0.229
Theta hat (MLE)	3237	Theta star (bias corrected MLE)	3246
nu hat (MLE)	15.14	nu star (bias corrected)	15.09
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (15.09, α)	7.328	Adjusted Chi Square Value (15.09, β)	7.049
95% Gamma Approximate UCL (use when n>=50)	1529	95% Gamma Adjusted UCL (use when n<50)	1590

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	769.5	SD (KM)	1543
Variance (KM)	2380210	SE of Mean (KM)	274.2
k hat (KM)	0.249	k star (KM)	0.246
nu hat (KM)	16.42	nu star (KM)	16.26
theta hat (KM)	3093	theta star (KM)	3124
80% gamma percentile (KM)	1112	90% gamma percentile (KM)	2312
95% gamma percentile (KM)	3741	99% gamma percentile (KM)	7553

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.26, α)	8.145	Adjusted Chi Square Value (16.26, β)	7.85
95% Gamma Approximate KM-UCL (use when n>=50)	1536	95% Gamma Adjusted KM-UCL (use when n<50)	1594

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.918	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.173	Detected Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	765.6	Mean in Log Scale	5.377
SD in Original Scale	1568	SD in Log Scale	1.548
95% t UCL (assumes normality of ROS data)	1228	95% Percentile Bootstrap UCL	1274
95% BCA Bootstrap UCL	1349	95% Bootstrap t UCL	1469
95% H-UCL (Log ROS)	1707		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.356	KM Geo Mean	211.9
KM SD (logged)	1.576	95% Critical H Value (KM-Log)	3.214
KM Standard Error of Mean (logged)	0.296	95% H-UCL (KM -Log)	1796
KM SD (logged)	1.576	95% Critical H Value (KM-Log)	3.214
KM Standard Error of Mean (logged)	0.296		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	782.9	Mean in Log Scale	5.481
SD in Original Scale	1561	SD in Log Scale	1.537
95% t UCL (Assumes normality)	1243	95% H-Stat UCL	1845

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1965

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	33	Number of Distinct Observations	28
Number of Detects	28	Number of Non-Detects	5
Number of Distinct Detects	25	Number of Distinct Non-Detects	5
Minimum Detect	12	Minimum Non-Detect	330
Maximum Detect	9500	Maximum Non-Detect	530
Variance Detects	6947143	Percent Non-Detects	15.15%
Mean Detects	1435	SD Detects	2636
Median Detects	330	CV Detects	1.837
Skewness Detects	2.407	Kurtosis Detects	4.701
Mean of Logged Detects	5.979	SD of Logged Detects	1.698

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.554	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.334	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1248	KM Standard Error of Mean	430.1
KM SD	2425	95% KM (BCA) UCL	2056
95% KM (t) UCL	1976	95% KM (Percentile Bootstrap) UCL	1990
95% KM (z) UCL	1955	95% KM Bootstrap t UCL	2475
90% KM Chebyshev UCL	2538	95% KM Chebyshev UCL	3122
97.5% KM Chebyshev UCL	3933	99% KM Chebyshev UCL	5527

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.604	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.812	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.237	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.175	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.493	k star (bias corrected MLE)	0.464
Theta hat (MLE)	2908	Theta star (bias corrected MLE)	3090
nu hat (MLE)	27.63	nu star (bias corrected)	26
Mean (detects)	1435		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1218
Maximum	9500	Median	320
SD	2477	CV	2.034
k hat (MLE)	0.259	k star (bias corrected MLE)	0.255
Theta hat (MLE)	4705	Theta star (bias corrected MLE)	4766
nu hat (MLE)	17.08	nu star (bias corrected)	16.86
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (16.86, α)	8.573	Adjusted Chi Square Value (16.86, β)	8.268
95% Gamma Approximate UCL (use when n>=50)	2395	95% Gamma Adjusted UCL (use when n<50)	2483

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1248	SD (KM)	2425
Variance (KM)	5882504	SE of Mean (KM)	430.1
k hat (KM)	0.265	k star (KM)	0.261
nu hat (KM)	17.47	nu star (KM)	17.21
theta hat (KM)	4714	theta star (KM)	4784
80% gamma percentile (KM)	1839	90% gamma percentile (KM)	3733
95% gamma percentile (KM)	5963	99% gamma percentile (KM)	11866

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.21, α)	8.825	Adjusted Chi Square Value (17.21, β)	8.515
95% Gamma Approximate KM-UCL (use when n>=50)	2434	95% Gamma Adjusted KM-UCL (use when n<50)	2522

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.953	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1240	Mean in Log Scale	5.827
SD in Original Scale	2466	SD in Log Scale	1.603
95% t UCL (assumes normality of ROS data)	1967	95% Percentile Bootstrap UCL	2015
95% BCA Bootstrap UCL	2213	95% Bootstrap t UCL	2450
95% H-UCL (Log ROS)	3084		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.815	KM Geo Mean	335.4
KM SD (logged)	1.64	95% Critical H Value (KM-Log)	3.307
KM Standard Error of Mean (logged)	0.303	95% H-UCL (KM -Log)	3359
KM SD (logged)	1.64	95% Critical H Value (KM-Log)	3.307
KM Standard Error of Mean (logged)	0.303		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1250	Mean in Log Scale	5.882
SD in Original Scale	2462	SD in Log Scale	1.579
95% t UCL (Assumes normality)	1976	95% H-Stat UCL	3061

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	3122

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	23	Number of Distinct Observations	21
Number of Detects	7	Number of Non-Detects	16
Number of Distinct Detects	7	Number of Distinct Non-Detects	16
Minimum Detect	30	Minimum Non-Detect	21
Maximum Detect	870	Maximum Non-Detect	530
Variance Detects	96627	Percent Non-Detects	69.57%
Mean Detects	166	SD Detects	310.8
Median Detects	52	CV Detects	1.873
Skewness Detects	2.631	Kurtosis Detects	6.94
Mean of Logged Detects	4.252	SD of Logged Detects	1.155

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.501	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.47	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	71.1	KM Standard Error of Mean	38.69
KM SD	171.2	95% KM (BCA) UCL	148.8
95% KM (t) UCL	137.5	95% KM (Percentile Bootstrap) UCL	144.1
95% KM (z) UCL	134.7	95% KM Bootstrap t UCL	499.9
90% KM Chebyshev UCL	187.2	95% KM Chebyshev UCL	239.8
97.5% KM Chebyshev UCL	312.7	99% KM Chebyshev UCL	456.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.38	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.739	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.418	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.324	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.702	k star (bias corrected MLE)	0.497
Theta hat (MLE)	236.4	Theta star (bias corrected MLE)	334.3
nu hat (MLE)	9.833	nu star (bias corrected)	6.952
Mean (detects)	166		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	50.53
Maximum	870	Median	0.01
SD	180.1	CV	3.565
k hat (MLE)	0.134	k star (bias corrected MLE)	0.145
Theta hat (MLE)	377.3	Theta star (bias corrected MLE)	347.4
nu hat (MLE)	6.161	nu star (bias corrected)	6.691
Adjusted Level of Significance (β)	0.0389		
Approximate Chi Square Value (6.69, α)	2.002	Adjusted Chi Square Value (6.69, β)	1.822
95% Gamma Approximate UCL (use when n>=50)	168.8	95% Gamma Adjusted UCL (use when n<50)	185.5

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	71.1	SD (KM)	171.2
Variance (KM)	29297	SE of Mean (KM)	38.69
k hat (KM)	0.173	k star (KM)	0.179
nu hat (KM)	7.937	nu star (KM)	8.236
theta hat (KM)	412	theta star (KM)	397.1
80% gamma percentile (KM)	87.92	90% gamma percentile (KM)	214.4
95% gamma percentile (KM)	376.6	99% gamma percentile (KM)	831.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.24, α)	2.872	Adjusted Chi Square Value (8.24, β)	2.647
95% Gamma Approximate KM-UCL (use when n>=50)	203.9	95% Gamma Adjusted KM-UCL (use when n<50)	221.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.714	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.325	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	60.03	Mean in Log Scale	3.046
SD in Original Scale	177.5	SD in Log Scale	1.09
95% t UCL (assumes normality of ROS data)	123.6	95% Percentile Bootstrap UCL	132.8
95% BCA Bootstrap UCL	170.2	95% Bootstrap t UCL	574.5
95% H-UCL (Log ROS)	70.44		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.589	KM Geo Mean	36.19
KM SD (logged)	0.803	95% Critical H Value (KM-Log)	2.283
KM Standard Error of Mean (logged)	0.201	95% H-UCL (KM -Log)	73.89
KM SD (logged)	0.803	95% Critical H Value (KM-Log)	2.283
KM Standard Error of Mean (logged)	0.201		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	119.4	Mean in Log Scale	4.061
SD in Original Scale	183.4	SD in Log Scale	1.194
95% t UCL (Assumes normality)	185	95% H-Stat UCL	241

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	239.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	33	Number of Distinct Observations	25
Number of Detects	11	Number of Non-Detects	22
Number of Distinct Detects	10	Number of Distinct Non-Detects	16
Minimum Detect	50	Minimum Non-Detect	0.72
Maximum Detect	1600	Maximum Non-Detect	530
Variance Detects	307126	Percent Non-Detects	66.67%
Mean Detects	510.2	SD Detects	554.2
Median Detects	230	CV Detects	1.086
Skewness Detects	1.131	Kurtosis Detects	-0.24
Mean of Logged Detects	5.608	SD of Logged Detects	1.236

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.792	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.271	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	191.8	KM Standard Error of Mean	71.13
KM SD	383.5	95% KM (BCA) UCL	330.4
95% KM (t) UCL	312.3	95% KM (Percentile Bootstrap) UCL	311.2
95% KM (z) UCL	308.8	95% KM Bootstrap t UCL	371.2
90% KM Chebyshev UCL	405.2	95% KM Chebyshev UCL	501.9
97.5% KM Chebyshev UCL	636	99% KM Chebyshev UCL	899.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.464	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.755	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.173	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.263	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.929	k star (bias corrected MLE)	0.736
Theta hat (MLE)	549.4	Theta star (bias corrected MLE)	693.2
nu hat (MLE)	20.43	nu star (bias corrected)	16.19
Mean (detects)	510.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	177.1
Maximum	1600	Median	0.01
SD	393	CV	2.219
k hat (MLE)	0.134	k star (bias corrected MLE)	0.142
Theta hat (MLE)	1324	Theta star (bias corrected MLE)	1249
nu hat (MLE)	8.828	nu star (bias corrected)	9.358
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (9.36, α)	3.545	Adjusted Chi Square Value (9.36, β)	3.362
95% Gamma Approximate UCL (use when n>=50)	467.6	95% Gamma Adjusted UCL (use when n<50)	493

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	191.8	SD (KM)	383.5
Variance (KM)	147054	SE of Mean (KM)	71.13
k hat (KM)	0.25	k star (KM)	0.248
nu hat (KM)	16.51	nu star (KM)	16.35
theta hat (KM)	766.6	theta star (KM)	774.5
80% gamma percentile (KM)	277.7	90% gamma percentile (KM)	576.1
95% gamma percentile (KM)	931.1	99% gamma percentile (KM)	1877

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (16.35, α)	8.207	Adjusted Chi Square Value (16.35, β)	7.91
95% Gamma Approximate KM-UCL (use when n>=50)	382.1	95% Gamma Adjusted KM-UCL (use when n<50)	396.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	189	Mean in Log Scale	3.844
SD in Original Scale	387.1	SD in Log Scale	1.594
95% t UCL (assumes normality of ROS data)	303.1	95% Percentile Bootstrap UCL	305
95% BCA Bootstrap UCL	343.6	95% Bootstrap t UCL	391.2
95% H-UCL (Log ROS)	415		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.456	KM Geo Mean	11.66
KM SD (logged)	2.928	95% Critical H Value (KM-Log)	5.331
KM Standard Error of Mean (logged)	0.66	95% H-UCL (KM -Log)	13371
KM SD (logged)	2.928	95% Critical H Value (KM-Log)	5.331
KM Standard Error of Mean (logged)	0.66		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	244.2	Mean in Log Scale	3.957
SD in Original Scale	372.3	SD in Log Scale	2.551
95% t UCL (Assumes normality)	354	95% H-Stat UCL	11392

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use if k<=1 and 15<n<50 but k<=1)	396.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	33	Number of Distinct Observations	29
Number of Detects	23	Number of Non-Detects	10
Number of Distinct Detects	21	Number of Distinct Non-Detects	8
Minimum Detect	18	Minimum Non-Detect	8.2
Maximum Detect	5000	Maximum Non-Detect	530
Variance Detects	2046024	Percent Non-Detects	30.3%
Mean Detects	821	SD Detects	1430
Median Detects	160	CV Detects	1.742
Skewness Detects	2.2	Kurtosis Detects	3.725
Mean of Logged Detects	5.496	SD of Logged Detects	1.583

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.589	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.314	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	599.9	KM Standard Error of Mean	216.6
KM SD	1216	95% KM (BCA) UCL	975.9
95% KM (t) UCL	966.9	95% KM (Percentile Bootstrap) UCL	969.7
95% KM (z) UCL	956.3	95% KM Bootstrap t UCL	1168
90% KM Chebyshev UCL	1250	95% KM Chebyshev UCL	1544
97.5% KM Chebyshev UCL	1953	99% KM Chebyshev UCL	2755

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.437	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.803	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.234	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.192	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.52	k star (bias corrected MLE)	0.481
Theta hat (MLE)	1579	Theta star (bias corrected MLE)	1707
nu hat (MLE)	23.92	nu star (bias corrected)	22.13
Mean (detects)	821		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	579.1
Maximum	5000	Median	110
SD	1244	CV	2.148
k hat (MLE)	0.203	k star (bias corrected MLE)	0.205
Theta hat (MLE)	2857	Theta star (bias corrected MLE)	2832
nu hat (MLE)	13.38	nu star (bias corrected)	13.5
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (13.50, α)	6.229	Adjusted Chi Square Value (13.50, β)	5.975
95% Gamma Approximate UCL (use when n>=50)	1255	95% Gamma Adjusted UCL (use when n<50)	1308

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	599.9	SD (KM)	1216
Variance (KM)	1478781	SE of Mean (KM)	216.6
k hat (KM)	0.243	k star (KM)	0.241
nu hat (KM)	16.06	nu star (KM)	15.94
theta hat (KM)	2465	theta star (KM)	2485
80% gamma percentile (KM)	860.3	90% gamma percentile (KM)	1805
95% gamma percentile (KM)	2934	99% gamma percentile (KM)	5954

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.94, α)	7.918	Adjusted Chi Square Value (15.94, β)	7.627
95% Gamma Approximate KM-UCL (use when n>=50)	1208	95% Gamma Adjusted KM-UCL (use when n<50)	1254

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.947	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.914	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.18	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	595.2	Mean in Log Scale	5.019
SD in Original Scale	1236	SD in Log Scale	1.625
95% t UCL (assumes normality of ROS data)	959.8	95% Percentile Bootstrap UCL	969.7
95% BCA Bootstrap UCL	1036	95% Bootstrap t UCL	1311
95% H-UCL (Log ROS)	1456		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.998	KM Geo Mean	148.1
KM SD (logged)	1.661	95% Critical H Value (KM-Log)	3.338
KM Standard Error of Mean (logged)	0.317	95% H-UCL (KM -Log)	1568
KM SD (logged)	1.661	95% Critical H Value (KM-Log)	3.338
KM Standard Error of Mean (logged)	0.317		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	620.8	Mean in Log Scale	5.199
SD in Original Scale	1226	SD in Log Scale	1.633
95% t UCL (Assumes normality)	982.4	95% H-Stat UCL	1778

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1544

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	33	Number of Distinct Observations	31
		Number of Missing Observations	0
Minimum	1200	Mean	5504
Maximum	12000	Median	4970
SD	2727	Std. Error of Mean	474.7
Coefficient of Variation	0.495	Skewness	0.545

Normal GOF Test

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.0983	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6308	95% Adjusted-CLT UCL (Chen-1995)	6333
		95% Modified-t UCL (Johnson-1978)	6316

Gamma GOF Test

A-D Test Statistic	0.265	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0913	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.154	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.75	k star (bias corrected MLE)	3.429
Theta hat (MLE)	1468	Theta star (bias corrected MLE)	1605
nu hat (MLE)	247.5	nu star (bias corrected)	226.3
MLE Mean (bias corrected)	5504	MLE Sd (bias corrected)	2972
		Approximate Chi Square Value (0.05)	192.5
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	190.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6471	95% Adjusted Gamma UCL (use when n<50)	6525

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.946	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.123	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.09	Mean of logged Data	8.474
Maximum of Logged Data	9.393	SD of logged Data	0.572

Assuming Lognormal Distribution

95% H-UCL	6903	90% Chebyshev (MVUE) UCL	7384
95% Chebyshev (MVUE) UCL	8187	97.5% Chebyshev (MVUE) UCL	9303
99% Chebyshev (MVUE) UCL	11495		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6285	95% Jackknife UCL	6308
95% Standard Bootstrap UCL	6275	95% Bootstrap-t UCL	6359
95% Hall's Bootstrap UCL	6375	95% Percentile Bootstrap UCL	6267
95% BCA Bootstrap UCL	6262		
90% Chebyshev(Mean, Sd) UCL	6928	95% Chebyshev(Mean, Sd) UCL	7573
97.5% Chebyshev(Mean, Sd) UCL	8468	99% Chebyshev(Mean, Sd) UCL	10227

Suggested UCL to Use

95% Student's-t UCL	6308

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	33	Number of Distinct Observations	26
Number of Detects	22	Number of Non-Detects	11
Number of Distinct Detects	21	Number of Distinct Non-Detects	6
Minimum Detect	0.21	Minimum Non-Detect	0.17
Maximum Detect	52	Maximum Non-Detect	6.6
Variance Detects	224.5	Percent Non-Detects	33.33%
Mean Detects	10.59	SD Detects	14.98
Median Detects	2.15	CV Detects	1.415
Skewness Detects	1.571	Kurtosis Detects	1.614
Mean of Logged Detects	1.15	SD of Logged Detects	1.73

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.727	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.321	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.29	KM Standard Error of Mean	2.288
KM SD	12.84	95% KM (BCA) UCL	11.56
95% KM (t) UCL	11.17	95% KM (Percentile Bootstrap) UCL	11.07
95% KM (z) UCL	11.05	95% KM Bootstrap t UCL	12.88
90% KM Chebyshev UCL	14.16	95% KM Chebyshev UCL	17.26
97.5% KM Chebyshev UCL	21.58	99% KM Chebyshev UCL	30.06

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.941	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.802	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.196	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.522	k star (bias corrected MLE)	0.481
Theta hat (MLE)	20.29	Theta star (bias corrected MLE)	22.01
nu hat (MLE)	22.96	nu star (bias corrected)	21.16
Mean (detects)	10.59		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	7.211
Maximum	52	Median	1.076
SD	13.09	CV	1.815
k hat (MLE)	0.287	k star (bias corrected MLE)	0.281
Theta hat (MLE)	25.14	Theta star (bias corrected MLE)	25.66
nu hat (MLE)	18.93	nu star (bias corrected)	18.55
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (18.55, α)	9.786	Adjusted Chi Square Value (18.55, β)	9.459
95% Gamma Approximate UCL (use when n>=50)	13.67	95% Gamma Adjusted UCL (use when n<50)	14.14

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.29	SD (KM)	12.84
Variance (KM)	164.8	SE of Mean (KM)	2.288
k hat (KM)	0.322	k star (KM)	0.313
nu hat (KM)	21.28	nu star (KM)	20.68
theta hat (KM)	22.61	theta star (KM)	23.26
80% gamma percentile (KM)	11.29	90% gamma percentile (KM)	21.38
95% gamma percentile (KM)	32.88	99% gamma percentile (KM)	62.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.68, α)	11.36	Adjusted Chi Square Value (20.68, β)	11
95% Gamma Approximate KM-UCL (use when n>=50)	13.28	95% Gamma Adjusted KM-UCL (use when n<50)	13.71

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.128	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	7.275	Mean in Log Scale	0.428
SD in Original Scale	13.04	SD in Log Scale	1.873
95% t UCL (assumes normality of ROS data)	11.12	95% Percentile Bootstrap UCL	11.1
95% BCA Bootstrap UCL	11.78	95% Bootstrap t UCL	12.51
95% H-UCL (Log ROS)	29.73		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.504	KM Geo Mean	1.655
KM SD (logged)	1.735	95% Critical H Value (KM-Log)	3.448
KM Standard Error of Mean (logged)	0.324	95% H-UCL (KM -Log)	21.48
KM SD (logged)	1.735	95% Critical H Value (KM-Log)	3.448
KM Standard Error of Mean (logged)	0.324		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7.41	Mean in Log Scale	0.65
SD in Original Scale	12.98	SD in Log Scale	1.689
95% t UCL (Assumes normality)	11.24	95% H-Stat UCL	21.88

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	17.26

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	33	Number of Distinct Observations	30
		Number of Missing Observations	0
Minimum	1.6	Mean	19.2
Maximum	77.2	Median	11
SD	19.57	Std. Error of Mean	3.407
Coefficient of Variation	1.019	Skewness	1.758

Normal GOF Test

Shapiro Wilk Test Statistic	0.756	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.244	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	24.97	95% Adjusted-CLT UCL (Chen-1995)	25.92
		95% Modified-t UCL (Johnson-1978)	25.14

Gamma GOF Test

A-D Test Statistic	0.927	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.769	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.157	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.325	k star (bias corrected MLE)	1.225
Theta hat (MLE)	14.49	Theta star (bias corrected MLE)	15.68
nu hat (MLE)	87.44	nu star (bias corrected)	80.82
MLE Mean (bias corrected)	19.2	MLE Sd (bias corrected)	17.35
		Approximate Chi Square Value (0.05)	61.11
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	60.22

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	25.39	95% Adjusted Gamma UCL (use when n<50)	25.77

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.975	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.111	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.47	Mean of logged Data	2.532
Maximum of Logged Data	4.346	SD of logged Data	0.931

Assuming Lognormal Distribution

95% H-UCL	28.62	90% Chebyshev (MVUE) UCL	29.61
95% Chebyshev (MVUE) UCL	34.38	97.5% Chebyshev (MVUE) UCL	41.01
99% Chebyshev (MVUE) UCL	54.04		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	24.8	95% Jackknife UCL	24.97
95% Standard Bootstrap UCL	24.84	95% Bootstrap-t UCL	26.51
95% Hall's Bootstrap UCL	25.66	95% Percentile Bootstrap UCL	24.96
95% BCA Bootstrap UCL	25.61		
90% Chebyshev(Mean, Sd) UCL	29.42	95% Chebyshev(Mean, Sd) UCL	34.05
97.5% Chebyshev(Mean, Sd) UCL	40.48	99% Chebyshev(Mean, Sd) UCL	53.1

Suggested UCL to Use

95% H-UCL	28.62

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	33	Number of Distinct Observations	29
Number of Detects	27	Number of Non-Detects	6
Number of Distinct Detects	27	Number of Distinct Non-Detects	3
Minimum Detect	0.13	Minimum Non-Detect	0.17
Maximum Detect	34	Maximum Non-Detect	1
Variance Detects	53.07	Percent Non-Detects	18.18%
Mean Detects	4.691	SD Detects	7.285
Median Detects	1.3	CV Detects	1.553
Skewness Detects	2.866	Kurtosis Detects	9.838
Mean of Logged Detects	0.54	SD of Logged Detects	1.514

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.646	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.266	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.892	KM Standard Error of Mean	1.186
KM SD	6.685	95% KM (BCA) UCL	6.341
95% KM (t) UCL	5.901	95% KM (Percentile Bootstrap) UCL	5.87
95% KM (z) UCL	5.843	95% KM Bootstrap t UCL	7.172
90% KM Chebyshev UCL	7.451	95% KM Chebyshev UCL	9.062
97.5% KM Chebyshev UCL	11.3	99% KM Chebyshev UCL	15.69

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.803	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.797	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.187	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.177	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.612	k star (bias corrected MLE)	0.569
Theta hat (MLE)	7.66	Theta star (bias corrected MLE)	8.244
nu hat (MLE)	33.07	nu star (bias corrected)	30.73
Mean (detects)	4.691		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.84
Maximum	34	Median	1
SD	6.818	CV	1.775
k hat (MLE)	0.381	k star (bias corrected MLE)	0.367
Theta hat (MLE)	10.08	Theta star (bias corrected MLE)	10.48
nu hat (MLE)	25.14	nu star (bias corrected)	24.19
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (24.19, α)	13.99	Adjusted Chi Square Value (24.19, β)	13.59
95% Gamma Approximate UCL (use when n>=50)	6.639	95% Gamma Adjusted UCL (use when n<50)	6.834

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.892	SD (KM)	6.685
Variance (KM)	44.69	SE of Mean (KM)	1.186
k hat (KM)	0.339	k star (KM)	0.328
nu hat (KM)	22.37	nu star (KM)	21.67
theta hat (KM)	11.48	theta star (KM)	11.85
80% gamma percentile (KM)	6.091	90% gamma percentile (KM)	11.35
95% gamma percentile (KM)	17.29	99% gamma percentile (KM)	32.57

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (21.67, α)	12.09	Adjusted Chi Square Value (21.67, β)	11.72
95% Gamma Approximate KM-UCL (use when n>=50)	6.976	95% Gamma Adjusted KM-UCL (use when n<50)	7.195

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.958	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.112	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.892	Mean in Log Scale	0.165
SD in Original Scale	6.789	SD in Log Scale	1.623
95% t UCL (assumes normality of ROS data)	5.894	95% Percentile Bootstrap UCL	5.976
95% BCA Bootstrap UCL	6.869	95% Bootstrap t UCL	7.352
95% H-UCL (Log ROS)	11.29		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.19	KM Geo Mean	1.209
KM SD (logged)	1.555	95% Critical H Value (KM-Log)	3.183
KM Standard Error of Mean (logged)	0.279	95% H-UCL (KM -Log)	9.716
KM SD (logged)	1.555	95% Critical H Value (KM-Log)	3.183
KM Standard Error of Mean (logged)	0.279		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.907	Mean in Log Scale	0.228
SD in Original Scale	6.781	SD in Log Scale	1.551
95% t UCL (Assumes normality)	5.906	95% H-Stat UCL	10

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	9.062

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	34	Number of Distinct Observations	29
Number of Detects	28	Number of Non-Detects	6
Number of Distinct Detects	23	Number of Distinct Non-Detects	6
Minimum Detect	0.56	Minimum Non-Detect	0.28
Maximum Detect	15.7	Maximum Non-Detect	2.5
Variance Detects	12.55	Percent Non-Detects	17.65%
Mean Detects	3.508	SD Detects	3.543
Median Detects	2.4	CV Detects	1.01
Skewness Detects	2.361	Kurtosis Detects	5.801
Mean of Logged Detects	0.908	SD of Logged Detects	0.813

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.71	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.262	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.982	KM Standard Error of Mean	0.588
KM SD	3.361	95% KM (BCA) UCL	3.986
95% KM (t) UCL	3.977	95% KM (Percentile Bootstrap) UCL	3.985
95% KM (z) UCL	3.949	95% KM Bootstrap t UCL	4.583
90% KM Chebyshev UCL	4.745	95% KM Chebyshev UCL	5.544
97.5% KM Chebyshev UCL	6.652	99% KM Chebyshev UCL	8.829

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.754	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.762	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.16	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.168	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.588	k star (bias corrected MLE)	1.442
Theta hat (MLE)	2.209	Theta star (bias corrected MLE)	2.433
nu hat (MLE)	88.94	nu star (bias corrected)	80.75
Mean (detects)	3.508		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.905
Maximum	15.7	Median	1.95
SD	3.468	CV	1.194
k hat (MLE)	0.607	k star (bias corrected MLE)	0.573
Theta hat (MLE)	4.785	Theta star (bias corrected MLE)	5.069
nu hat (MLE)	41.28	nu star (bias corrected)	38.97
Adjusted Level of Significance (β)	0.0422		
Approximate Chi Square Value (38.97, α)	25.67	Adjusted Chi Square Value (38.97, β)	25.14
95% Gamma Approximate UCL (use when n>=50)	4.41	95% Gamma Adjusted UCL (use when n<50)	4.504

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.982	SD (KM)	3.361
Variance (KM)	11.3	SE of Mean (KM)	0.588
k hat (KM)	0.787	k star (KM)	0.737
nu hat (KM)	53.54	nu star (KM)	50.15
theta hat (KM)	3.788	theta star (KM)	4.044
80% gamma percentile (KM)	4.893	90% gamma percentile (KM)	7.395
95% gamma percentile (KM)	9.963	99% gamma percentile (KM)	16.07

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (50.15, α)	34.89	Adjusted Chi Square Value (50.15, β)	34.26
95% Gamma Approximate KM-UCL (use when n>=50)	4.287	95% Gamma Adjusted KM-UCL (use when n<50)	4.366

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.973	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.924	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0989	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.164	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.992	Mean in Log Scale	0.637
SD in Original Scale	3.4	SD in Log Scale	0.963
95% t UCL (assumes normality of ROS data)	3.979	95% Percentile Bootstrap UCL	3.981
95% BCA Bootstrap UCL	4.263	95% Bootstrap t UCL	4.529
95% H-UCL (Log ROS)	4.495		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.59	KM Geo Mean	1.804
KM SD (logged)	1.034	95% Critical H Value (KM-Log)	2.488
KM Standard Error of Mean (logged)	0.183	95% H-UCL (KM -Log)	4.819
KM SD (logged)	1.034	95% Critical H Value (KM-Log)	2.488
KM Standard Error of Mean (logged)	0.183		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.97	Mean in Log Scale	0.547
SD in Original Scale	3.419	SD in Log Scale	1.138
95% t UCL (Assumes normality)	3.963	95% H-Stat UCL	5.548

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	4.366	95% GROS Adjusted Gamma UCL	4.504

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	33	Number of Distinct Observations	31
Number of Detects	32	Number of Non-Detects	1
Number of Distinct Detects	30	Number of Distinct Non-Detects	1
Minimum Detect	1.7	Minimum Non-Detect	10
Maximum Detect	22.1	Maximum Non-Detect	10
Variance Detects	23.25	Percent Non-Detects	3.03%
Mean Detects	8.113	SD Detects	4.821
Median Detects	7.25	CV Detects	0.594
Skewness Detects	1.108	Kurtosis Detects	1.026
Mean of Logged Detects	1.923	SD of Logged Detects	0.611

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.123	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.044	KM Standard Error of Mean	0.836
KM SD	4.707	95% KM (BCA) UCL	9.464
95% KM (t) UCL	9.459	95% KM (Percentile Bootstrap) UCL	9.443
95% KM (z) UCL	9.418	95% KM Bootstrap t UCL	9.679
90% KM Chebyshev UCL	10.55	95% KM Chebyshev UCL	11.69
97.5% KM Chebyshev UCL	13.26	99% KM Chebyshev UCL	16.36

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.176	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.753	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0769	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.157	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.082	k star (bias corrected MLE)	2.814
Theta hat (MLE)	2.632	Theta star (bias corrected MLE)	2.883
nu hat (MLE)	197.3	nu star (bias corrected)	180.1
Mean (detects)	8.113		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	1.7	Mean	8.043
Maximum	22.1	Median	7.2
SD	4.762	CV	0.592
k hat (MLE)	3.147	k star (bias corrected MLE)	2.881
Theta hat (MLE)	2.555	Theta star (bias corrected MLE)	2.791
nu hat (MLE)	207.7	nu star (bias corrected)	190.2
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (190.17, α)	159.3	Adjusted Chi Square Value (190.17, β)	157.8
95% Gamma Approximate UCL (use when n>=50)	9.603	95% Gamma Adjusted UCL (use when n<50)	9.692

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.044	SD (KM)	4.707
Variance (KM)	22.15	SE of Mean (KM)	0.836
k hat (KM)	2.921	k star (KM)	2.676
nu hat (KM)	192.8	nu star (KM)	176.6
theta hat (KM)	2.754	theta star (KM)	3.007
80% gamma percentile (KM)	11.63	90% gamma percentile (KM)	14.63
95% gamma percentile (KM)	17.45	99% gamma percentile (KM)	23.6

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (176.58, α)	146.8	Adjusted Chi Square Value (176.58, β)	145.5
95% Gamma Approximate KM-UCL (use when n>=50)	9.673	95% Gamma Adjusted KM-UCL (use when n<50)	9.765

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.985	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.93	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0649	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.154	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.035	Mean in Log Scale	1.916
SD in Original Scale	4.767	SD in Log Scale	0.602
95% t UCL (assumes normality of ROS data)	9.44	95% Percentile Bootstrap UCL	9.41
95% BCA Bootstrap UCL	9.601	95% Bootstrap t UCL	9.705
95% H-UCL (Log ROS)	10.1		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.915	KM Geo Mean	6.786
KM SD (logged)	0.599	95% Critical H Value (KM-Log)	2.018
KM Standard Error of Mean (logged)	0.107	95% H-UCL (KM -Log)	10.05
KM SD (logged)	0.599	95% Critical H Value (KM-Log)	2.018
KM Standard Error of Mean (logged)	0.107		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8.018	Mean in Log Scale	1.913
SD in Original Scale	4.776	SD in Log Scale	0.603
95% t UCL (Assumes normality)	9.427	95% H-Stat UCL	10.08

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	9.459

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	33	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	15.8	Mean	6218
Maximum	191000	Median	85
SD	33180	Std. Error of Mean	5776
Coefficient of Variation	5.336	Skewness	5.74

Normal GOF Test

Shapiro Wilk Test Statistic	0.191	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.506	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	16002	95% Adjusted-CLT UCL (Chen-1995)	21885
		95% Modified-t UCL (Johnson-1978)	16963

Gamma GOF Test

A-D Test Statistic	6.606	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.903	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.334	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.17	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.205	k star (bias corrected MLE)	0.207
Theta hat (MLE)	30302	Theta star (bias corrected MLE)	30075
nu hat (MLE)	13.54	nu star (bias corrected)	13.65
MLE Mean (bias corrected)	6218	MLE Sd (bias corrected)	13675
		Approximate Chi Square Value (0.05)	6.329
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	6.073

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	13405	95% Adjusted Gamma UCL (use when n<50)	13971

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.207	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.76	Mean of logged Data	5.163
Maximum of Logged Data	12.16	SD of logged Data	1.927

Assuming Lognormal Distribution

95% H-UCL	3998	90% Chebyshev (MVUE) UCL	2299
95% Chebyshev (MVUE) UCL	2900	97.5% Chebyshev (MVUE) UCL	3734
99% Chebyshev (MVUE) UCL	5373		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	15718	95% Jackknife UCL	16002
95% Standard Bootstrap UCL	15921	95% Bootstrap-t UCL	368934
95% Hall's Bootstrap UCL	238931	95% Percentile Bootstrap UCL	17740
95% BCA Bootstrap UCL	23805		
90% Chebyshev(Mean, Sd) UCL	23546	95% Chebyshev(Mean, Sd) UCL	31395
97.5% Chebyshev(Mean, Sd) UCL	42289	99% Chebyshev(Mean, Sd) UCL	63688

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	31395

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	23	Number of Distinct Observations	20
Number of Detects	10	Number of Non-Detects	13
Number of Distinct Detects	10	Number of Distinct Non-Detects	12
Minimum Detect	0.26	Minimum Non-Detect	0.205
Maximum Detect	3.7	Maximum Non-Detect	0.68
Variance Detects	1.089	Percent Non-Detects	56.52%
Mean Detects	0.788	SD Detects	1.044
Median Detects	0.445	CV Detects	1.325
Skewness Detects	2.945	Kurtosis Detects	8.937
Mean of Logged Detects	-0.636	SD of Logged Detects	0.792

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.532	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.487	KM Standard Error of Mean	0.156
KM SD	0.707	95% KM (BCA) UCL	0.825
95% KM (t) UCL	0.755	95% KM (Percentile Bootstrap) UCL	0.768
95% KM (z) UCL	0.744	95% KM Bootstrap t UCL	1.463
90% KM Chebyshev UCL	0.955	95% KM Chebyshev UCL	1.167
97.5% KM Chebyshev UCL	1.461	99% KM Chebyshev UCL	2.039

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.243	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.741	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.307	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.272	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.399	k star (bias corrected MLE)	1.046
Theta hat (MLE)	0.563	Theta star (bias corrected MLE)	0.753
nu hat (MLE)	27.99	nu star (bias corrected)	20.92
Mean (detects)	0.788		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.348
Maximum	3.7	Median	0.01
SD	0.775	CV	2.226
k hat (MLE)	0.366	k star (bias corrected MLE)	0.347
Theta hat (MLE)	0.952	Theta star (bias corrected MLE)	1.003
nu hat (MLE)	16.83	nu star (bias corrected)	15.97
Adjusted Level of Significance (β)	0.0389		
Approximate Chi Square Value (15.97, α)	7.939	Adjusted Chi Square Value (15.97, β)	7.53
95% Gamma Approximate UCL (use when n>=50)	0.7	95% Gamma Adjusted UCL (use when n<50)	0.738

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.487	SD (KM)	0.707
Variance (KM)	0.499	SE of Mean (KM)	0.156
k hat (KM)	0.475	k star (KM)	0.442
nu hat (KM)	21.87	nu star (KM)	20.35
theta hat (KM)	1.025	theta star (KM)	1.101
80% gamma percentile (KM)	0.794	90% gamma percentile (KM)	1.351
95% gamma percentile (KM)	1.955	99% gamma percentile (KM)	3.457

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.35, α)	11.11	Adjusted Chi Square Value (20.35, β)	10.61
95% Gamma Approximate KM-UCL (use when n>=50)	0.892	95% Gamma Adjusted KM-UCL (use when n<50)	0.934

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.802	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.237	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.438	Mean in Log Scale	-1.314
SD in Original Scale	0.739	SD in Log Scale	0.837
95% t UCL (assumes normality of ROS data)	0.703	95% Percentile Bootstrap UCL	0.737
95% BCA Bootstrap UCL	0.907	95% Bootstrap t UCL	1.46
95% H-UCL (Log ROS)	0.578		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.068	KM Geo Mean	0.344
KM SD (logged)	0.653	95% Critical H Value (KM-Log)	2.118
KM Standard Error of Mean (logged)	0.151	95% H-UCL (KM -Log)	0.571
KM SD (logged)	0.653	95% Critical H Value (KM-Log)	2.118
KM Standard Error of Mean (logged)	0.151		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.47	Mean in Log Scale	-1.163
SD in Original Scale	0.729	SD in Log Scale	0.762
95% t UCL (Assumes normality)	0.731	95% H-Stat UCL	0.601

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.571

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	33	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	2840	Mean	22036
Maximum	94000	Median	14800
SD	23762	Std. Error of Mean	4136
Coefficient of Variation	1.078	Skewness	2.156

Normal GOF Test

Shapiro Wilk Test Statistic	0.687	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.291	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	29043	95% Adjusted-CLT UCL (Chen-1995)	30499
		95% Modified-t UCL (Johnson-1978)	29301

Gamma GOF Test

A-D Test Statistic	1.204	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.768	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.156	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.379	k star (bias corrected MLE)	1.274
Theta hat (MLE)	15978	Theta star (bias corrected MLE)	17297
nu hat (MLE)	91.03	nu star (bias corrected)	84.08
MLE Mean (bias corrected)	22036	MLE Sd (bias corrected)	19523
		Approximate Chi Square Value (0.05)	63.95
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	63.05

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	28974	95% Adjusted Gamma UCL (use when n<50)	29389

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.12	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.952	Mean of logged Data	9.596
Maximum of Logged Data	11.45	SD of logged Data	0.88

Assuming Lognormal Distribution

95% H-UCL	30978	90% Chebyshev (MVUE) UCL	32341
95% Chebyshev (MVUE) UCL	37335	97.5% Chebyshev (MVUE) UCL	44265
99% Chebyshev (MVUE) UCL	57879		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	28840	95% Jackknife UCL	29043
95% Standard Bootstrap UCL	28749	95% Bootstrap-t UCL	31805
95% Hall's Bootstrap UCL	30324	95% Percentile Bootstrap UCL	29021
95% BCA Bootstrap UCL	31164		
90% Chebyshev(Mean, Sd) UCL	34445	95% Chebyshev(Mean, Sd) UCL	40066
97.5% Chebyshev(Mean, Sd) UCL	47868	99% Chebyshev(Mean, Sd) UCL	63193

Suggested UCL to Use

95% H-UCL 30978

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	33	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	6.4	Mean	1137
Maximum	13000	Median	97
SD	3037	Std. Error of Mean	528.6
Coefficient of Variation	2.671	Skewness	3.527

Normal GOF Test

Shapiro Wilk Test Statistic	0.41	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.374	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2032	95% Adjusted-CLT UCL (Chen-1995)	2353
		95% Modified-t UCL (Johnson-1978)	2086

Gamma GOF Test

A-D Test Statistic	2.809	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.851	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.232	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.166	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.321	k star (bias corrected MLE)	0.312
Theta hat (MLE)	3545	Theta star (bias corrected MLE)	3647
nu hat (MLE)	21.16	nu star (bias corrected)	20.57
MLE Mean (bias corrected)	1137	MLE Sd (bias corrected)	2036
		Approximate Chi Square Value (0.05)	11.28
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	10.92

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2074	95% Adjusted Gamma UCL (use when n<50)	2142

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.13	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.856	Mean of logged Data	4.909
Maximum of Logged Data	9.473	SD of logged Data	2.001

Assuming Lognormal Distribution

95% H-UCL	3923	90% Chebyshev (MVUE) UCL	2082
95% Chebyshev (MVUE) UCL	2637	97.5% Chebyshev (MVUE) UCL	3407
99% Chebyshev (MVUE) UCL	4919		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2006	95% Jackknife UCL	2032
95% Standard Bootstrap UCL	1957	95% Bootstrap-t UCL	4538
95% Hall's Bootstrap UCL	5851	95% Percentile Bootstrap UCL	2141
95% BCA Bootstrap UCL	2565		
90% Chebyshev(Mean, Sd) UCL	2723	95% Chebyshev(Mean, Sd) UCL	3441
97.5% Chebyshev(Mean, Sd) UCL	4438	99% Chebyshev(Mean, Sd) UCL	6397

Suggested UCL to Use

97.5% Chebyshev (Mean, Sd) UCL	4438

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	48	Mean	1389
Maximum	6400	Median	200
SD	2802	Std. Error of Mean	1253
Coefficient of Variation	2.017	Skewness	2.231

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.579	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.459	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4061	95% Adjusted-CLT UCL (Chen-1995)	4787
		95% Modified-t UCL (Johnson-1978)	4269

Gamma GOF Test

A-D Test Statistic	0.772	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.408	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.377	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.381	k star (bias corrected MLE)	0.286
Theta hat (MLE)	3642	Theta star (bias corrected MLE)	4859
nu hat (MLE)	3.815	nu star (bias corrected)	2.859
MLE Mean (bias corrected)	1389	MLE Sd (bias corrected)	2598
		Approximate Chi Square Value (0.05)	0.332
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.124

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	11967	95% Adjusted Gamma UCL (use when n<50)	32011

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.304	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.871	Mean of logged Data	5.498
Maximum of Logged Data	8.764	SD of logged Data	1.96

Assuming Lognormal Distribution

95% H-UCL	13842176	90% Chebyshev (MVUE) UCL	2772
95% Chebyshev (MVUE) UCL	3634	97.5% Chebyshev (MVUE) UCL	4830
99% Chebyshev (MVUE) UCL	7179		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3451	95% Jackknife UCL	4061
95% Standard Bootstrap UCL	3260	95% Bootstrap-t UCL	55500
95% Hall's Bootstrap UCL	50286	95% Percentile Bootstrap UCL	3864
95% BCA Bootstrap UCL	3928		
90% Chebyshev(Mean, Sd) UCL	5149	95% Chebyshev(Mean, Sd) UCL	6852
97.5% Chebyshev(Mean, Sd) UCL	9216	99% Chebyshev(Mean, Sd) UCL	13859

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	13859

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	120	Mean	1046
Maximum	4200	Median	290
SD	1765	Std. Error of Mean	789.5
Coefficient of Variation	1.688	Skewness	2.222

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.6	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.451	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2729	95% Adjusted-CLT UCL (Chen-1995)	3183
		95% Modified-t UCL (Johnson-1978)	2860

Gamma GOF Test

A-D Test Statistic	0.832	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.702	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.422	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.368	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.673	k star (bias corrected MLE)	0.402
Theta hat (MLE)	1555	Theta star (bias corrected MLE)	2599
nu hat (MLE)	6.728	nu star (bias corrected)	4.024
MLE Mean (bias corrected)	1046	MLE Sd (bias corrected)	1649
		Approximate Chi Square Value (0.05)	0.731
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.302

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	5756	95% Adjusted Gamma UCL (use when n<50)	13927

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.821	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.348	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.787	Mean of logged Data	6.049
Maximum of Logged Data	8.343	SD of logged Data	1.347

Assuming Lognormal Distribution

95% H-UCL	80161	90% Chebyshev (MVUE) UCL	2174
95% Chebyshev (MVUE) UCL	2789	97.5% Chebyshev (MVUE) UCL	3642
99% Chebyshev (MVUE) UCL	5319		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2345	95% Jackknife UCL	2729
95% Standard Bootstrap UCL	2231	95% Bootstrap-t UCL	26764
95% Hall's Bootstrap UCL	24428	95% Percentile Bootstrap UCL	2568
95% BCA Bootstrap UCL	2624		
90% Chebyshev(Mean, Sd) UCL	3414	95% Chebyshev(Mean, Sd) UCL	4487
97.5% Chebyshev(Mean, Sd) UCL	5976	99% Chebyshev(Mean, Sd) UCL	8901

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	4487

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	70	Mean	1307
Maximum	5900	Median	220
SD	2569	Std. Error of Mean	1149
Coefficient of Variation	1.966	Skewness	2.23

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.581	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.458	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3756	95% Adjusted-CLT UCL (Chen-1995)	4421
		95% Modified-t UCL (Johnson-1978)	3947

Gamma GOF Test

A-D Test Statistic	0.82	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.418	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.375	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.43	k star (bias corrected MLE)	0.305
Theta hat (MLE)	3038	Theta star (bias corrected MLE)	4279
nu hat (MLE)	4.301	nu star (bias corrected)	3.054
MLE Mean (bias corrected)	1307	MLE Sd (bias corrected)	2365
		Approximate Chi Square Value (0.05)	0.389
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.145

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	10271	95% Adjusted Gamma UCL (use when n<50)	27454

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.815	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.323	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.248	Mean of logged Data	5.663
Maximum of Logged Data	8.683	SD of logged Data	1.783

Assuming Lognormal Distribution

95% H-UCL	2531256	90% Chebyshev (MVUE) UCL	2589
95% Chebyshev (MVUE) UCL	3378	97.5% Chebyshev (MVUE) UCL	4473
99% Chebyshev (MVUE) UCL	6625		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3197	95% Jackknife UCL	3756
95% Standard Bootstrap UCL	3004	95% Bootstrap-t UCL	48317
95% Hall's Bootstrap UCL	47732	95% Percentile Bootstrap UCL	3571
95% BCA Bootstrap UCL	3636		
90% Chebyshev(Mean, Sd) UCL	4753	95% Chebyshev(Mean, Sd) UCL	6315
97.5% Chebyshev(Mean, Sd) UCL	8482	99% Chebyshev(Mean, Sd) UCL	12738

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	12738

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	33	Number of Distinct Observations	31
		Number of Missing Observations	0
Minimum	7.2	Mean	303.7
Maximum	1400	Median	270
SD	273.5	Std. Error of Mean	47.61
Coefficient of Variation	0.901	Skewness	2.126

Normal GOF Test

Shapiro Wilk Test Statistic	0.822	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	384.3	95% Adjusted-CLT UCL (Chen-1995)	400.8
		95% Modified-t UCL (Johnson-1978)	387.3

Gamma GOF Test

A-D Test Statistic	0.24	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.77	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0968	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.157	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.285	k star (bias corrected MLE)	1.188
Theta hat (MLE)	236.4	Theta star (bias corrected MLE)	255.6
nu hat (MLE)	84.8	nu star (bias corrected)	78.42
MLE Mean (bias corrected)	303.7	MLE Sd (bias corrected)	278.6
		Approximate Chi Square Value (0.05)	59.02
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	58.15

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	403.5	95% Adjusted Gamma UCL (use when n<50)	409.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.974	Mean of logged Data	5.279
Maximum of Logged Data	7.244	SD of logged Data	1.092

Assuming Lognormal Distribution

95% H-UCL	582.2	90% Chebyshev (MVUE) UCL	578.7
95% Chebyshev (MVUE) UCL	684	97.5% Chebyshev (MVUE) UCL	830.2
99% Chebyshev (MVUE) UCL	1117		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	382	95% Jackknife UCL	384.3
95% Standard Bootstrap UCL	380.6	95% Bootstrap-t UCL	408.1
95% Hall's Bootstrap UCL	447.8	95% Percentile Bootstrap UCL	383.6
95% BCA Bootstrap UCL	409.8		
90% Chebyshev(Mean, Sd) UCL	446.5	95% Chebyshev(Mean, Sd) UCL	511.2
97.5% Chebyshev(Mean, Sd) UCL	601	99% Chebyshev(Mean, Sd) UCL	777.4

Suggested UCL to Use

95% Student's-t UCL	384.3

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	33	Number of Distinct Observations	30
		Number of Missing Observations	0
Minimum	7.3	Mean	60.84
Maximum	402	Median	30
SD	82.53	Std. Error of Mean	14.37
Coefficient of Variation	1.356	Skewness	2.86

Normal GOF Test

Shapiro Wilk Test Statistic	0.637	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	85.18	95% Adjusted-CLT UCL (Chen-1995)	92.11
		95% Modified-t UCL (Johnson-1978)	86.37

Gamma GOF Test

A-D Test Statistic	1.473	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.775	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.175	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.158	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.022	k star (bias corrected MLE)	0.949
Theta hat (MLE)	59.56	Theta star (bias corrected MLE)	64.12
nu hat (MLE)	67.42	nu star (bias corrected)	62.63
MLE Mean (bias corrected)	60.84	MLE Sd (bias corrected)	62.46
		Approximate Chi Square Value (0.05)	45.42
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	44.67

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	83.89	95% Adjusted Gamma UCL (use when n<50)	85.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.12	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.988	Mean of logged Data	3.545
Maximum of Logged Data	5.996	SD of logged Data	1.007

Assuming Lognormal Distribution

95% H-UCL	88.88	90% Chebyshev (MVUE) UCL	90.43
95% Chebyshev (MVUE) UCL	105.9	97.5% Chebyshev (MVUE) UCL	127.4
99% Chebyshev (MVUE) UCL	169.6		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	84.47	95% Jackknife UCL	85.18
95% Standard Bootstrap UCL	84.08	95% Bootstrap-t UCL	103.4
95% Hall's Bootstrap UCL	181	95% Percentile Bootstrap UCL	85.08
95% BCA Bootstrap UCL	94.45		
90% Chebyshev(Mean, Sd) UCL	103.9	95% Chebyshev(Mean, Sd) UCL	123.5
97.5% Chebyshev(Mean, Sd) UCL	150.6	99% Chebyshev(Mean, Sd) UCL	203.8

Suggested UCL to Use

95% H-UCL	88.88

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	33	Number of Distinct Observations	21
Number of Detects	22	Number of Non-Detects	11
Number of Distinct Detects	19	Number of Distinct Non-Detects	4
Minimum Detect	0.1	Minimum Non-Detect	0.039
Maximum Detect	4.5	Maximum Non-Detect	2
Variance Detects	1.163	Percent Non-Detects	33.33%
Mean Detects	1.057	SD Detects	1.078
Median Detects	0.81	CV Detects	1.02
Skewness Detects	1.623	Kurtosis Detects	3.624
Mean of Logged Detects	-0.537	SD of Logged Detects	1.206

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.813	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.879	KM Standard Error of Mean	0.185
KM SD	0.964	95% KM (BCA) UCL	1.174
95% KM (t) UCL	1.191	95% KM (Percentile Bootstrap) UCL	1.184
95% KM (z) UCL	1.182	95% KM Bootstrap t UCL	1.252
90% KM Chebyshev UCL	1.433	95% KM Chebyshev UCL	1.684
97.5% KM Chebyshev UCL	2.032	99% KM Chebyshev UCL	2.716

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.83	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.772	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.191	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.978	k star (bias corrected MLE)	0.875
Theta hat (MLE)	1.081	Theta star (bias corrected MLE)	1.208
nu hat (MLE)	43.01	nu star (bias corrected)	38.48
Mean (detects)	1.057		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.859
Maximum	4.5	Median	0.41
SD	0.962	CV	1.121
k hat (MLE)	0.736	k star (bias corrected MLE)	0.689
Theta hat (MLE)	1.167	Theta star (bias corrected MLE)	1.246
nu hat (MLE)	48.59	nu star (bias corrected)	45.5
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (45.50, α)	31.03	Adjusted Chi Square Value (45.50, β)	30.41
95% Gamma Approximate UCL (use when n>=50)	1.259	95% Gamma Adjusted UCL (use when n<50)	1.285

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.879	SD (KM)	0.964
Variance (KM)	0.929	SE of Mean (KM)	0.185
k hat (KM)	0.831	k star (KM)	0.775
nu hat (KM)	54.82	nu star (KM)	51.17
theta hat (KM)	1.058	theta star (KM)	1.133
80% gamma percentile (KM)	1.438	90% gamma percentile (KM)	2.153
95% gamma percentile (KM)	2.883	99% gamma percentile (KM)	4.61

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (51.17, α)	35.74	Adjusted Chi Square Value (51.17, β)	35.08
95% Gamma Approximate KM-UCL (use when n>=50)	1.258	95% Gamma Adjusted KM-UCL (use when n<50)	1.282

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.177	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.835	Mean in Log Scale	-0.848
SD in Original Scale	0.957	SD in Log Scale	1.252
95% t UCL (assumes normality of ROS data)	1.117	95% Percentile Bootstrap UCL	1.119
95% BCA Bootstrap UCL	1.16	95% Bootstrap t UCL	1.184
95% H-UCL (Log ROS)	1.728		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.857	KM Geo Mean	0.424
KM SD (logged)	1.33	95% Critical H Value (KM-Log)	2.866
KM Standard Error of Mean (logged)	0.272	95% H-UCL (KM -Log)	2.015
KM SD (logged)	1.33	95% Critical H Value (KM-Log)	2.866
KM Standard Error of Mean (logged)	0.272		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.968	Mean in Log Scale	-0.6
SD in Original Scale	0.91	SD in Log Scale	1.296
95% t UCL (Assumes normality)	1.236	95% H-Stat UCL	2.428

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (useif k<=1 and 15<n<50 but k<=1)	1.282

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	33	Number of Distinct Observations	29
		Number of Missing Observations	0
Minimum	0.91	Mean	27.11
Maximum	92.6	Median	21
SD	20.48	Std. Error of Mean	3.565
Coefficient of Variation	0.755	Skewness	1.425

Normal GOF Test

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	33.15	95% Adjusted-CLT UCL (Chen-1995)	33.92
		95% Modified-t UCL (Johnson-1978)	33.3

Gamma GOF Test

A-D Test Statistic	0.394	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.764	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0904	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.156	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.614	k star (bias corrected MLE)	1.488
Theta hat (MLE)	16.8	Theta star (bias corrected MLE)	18.23
nu hat (MLE)	106.5	nu star (bias corrected)	98.18
MLE Mean (bias corrected)	27.11	MLE Sd (bias corrected)	22.23
		Approximate Chi Square Value (0.05)	76.32
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	75.33

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	34.88	95% Adjusted Gamma UCL (use when n<50)	35.34

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.0943	Mean of logged Data	2.959
Maximum of Logged Data	4.528	SD of logged Data	0.987

Assuming Lognormal Distribution

95% H-UCL	47.9	90% Chebyshev (MVUE) UCL	48.96
95% Chebyshev (MVUE) UCL	57.22	97.5% Chebyshev (MVUE) UCL	68.69
99% Chebyshev (MVUE) UCL	91.2		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	32.98	95% Jackknife UCL	33.15
95% Standard Bootstrap UCL	33	95% Bootstrap-t UCL	34.58
95% Hall's Bootstrap UCL	34.45	95% Percentile Bootstrap UCL	33.07
95% BCA Bootstrap UCL	33.61		
90% Chebyshev(Mean, Sd) UCL	37.81	95% Chebyshev(Mean, Sd) UCL	42.65
97.5% Chebyshev(Mean, Sd) UCL	49.38	99% Chebyshev(Mean, Sd) UCL	62.59

Suggested UCL to Use

95% Adjusted Gamma UCL	35.34

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	33	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	9.2	Mean	797
Maximum	11500	Median	159
SD	2054	Std. Error of Mean	357.6
Coefficient of Variation	2.578	Skewness	4.731

Normal GOF Test

Shapiro Wilk Test Statistic	0.405	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.351	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1403	95% Adjusted-CLT UCL (Chen-1995)	1700
		95% Modified-t UCL (Johnson-1978)	1452

Gamma GOF Test

A-D Test Statistic	1.952	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.826	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.163	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.433	k star (bias corrected MLE)	0.414
Theta hat (MLE)	1841	Theta star (bias corrected MLE)	1926
nu hat (MLE)	28.58	nu star (bias corrected)	27.31
MLE Mean (bias corrected)	797	MLE Sd (bias corrected)	1239
		Approximate Chi Square Value (0.05)	16.39
Adjusted Level of Significance	0.0419	Adjusted Chi Square Value	15.96

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1328	95% Adjusted Gamma UCL (use when n<50)	1364

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.931	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.101	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.152	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.219	Mean of logged Data	5.18
Maximum of Logged Data	9.35	SD of logged Data	1.68

Assuming Lognormal Distribution

95% H-UCL	1978	90% Chebyshev (MVUE) UCL	1428
95% Chebyshev (MVUE) UCL	1774	97.5% Chebyshev (MVUE) UCL	2255
99% Chebyshev (MVUE) UCL	3199		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1385	95% Jackknife UCL	1403
95% Standard Bootstrap UCL	1401	95% Bootstrap-t UCL	2557
95% Hall's Bootstrap UCL	3310	95% Percentile Bootstrap UCL	1451
95% BCA Bootstrap UCL	1839		
90% Chebyshev(Mean, Sd) UCL	1870	95% Chebyshev(Mean, Sd) UCL	2356
97.5% Chebyshev(Mean, Sd) UCL	3030	99% Chebyshev(Mean, Sd) UCL	4355

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	2356

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	23	Number of Distinct Observations	16
Number of Detects	2	Number of Non-Detects	21
Number of Distinct Detects	2	Number of Distinct Non-Detects	14
Minimum Detect	340	Minimum Non-Detect	21
Maximum Detect	770	Maximum Non-Detect	480
Variance Detects	92450	Percent Non-Detects	91.3%
Mean Detects	555	SD Detects	304.1
Median Detects	555	CV Detects	0.548
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	6.238	SD of Logged Detects	0.578

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	68.1	KM Standard Error of Mean	48.47
KM SD	163.7	95% KM (BCA) UCL	N/A
95% KM (t) UCL	151.3	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	147.8	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	213.5	95% KM Chebyshev UCL	279.4
97.5% KM Chebyshev UCL	370.8	99% KM Chebyshev UCL	550.4

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	6.312	k star (bias corrected MLE)	N/A
Theta hat (MLE)	87.93	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	25.25	nu star (bias corrected)	N/A
Mean (detects)	555		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	68.1	SD (KM)	163.7
Variance (KM)	26808	SE of Mean (KM)	48.47
k hat (KM)	0.173	k star (KM)	0.179
nu hat (KM)	7.956	nu star (KM)	8.252
theta hat (KM)	393.7	theta star (KM)	379.6
80% gamma percentile (KM)	84.31	90% gamma percentile (KM)	205.3
95% gamma percentile (KM)	360.5	99% gamma percentile (KM)	795.8

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0389
Approximate Chi Square Value (8.25, α)	2.882	Adjusted Chi Square Value (8.25, β)	2.656
95% Gamma Approximate KM-UCL (use when n>=50)	195	95% Gamma Adjusted KM-UCL (use when n<50)	211.6

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	76.03	Mean in Log Scale	3.513
SD in Original Scale	165.5	SD in Log Scale	1.034
95% t UCL (assumes normality of ROS data)	135.3	95% Percentile Bootstrap UCL	137.8
95% BCA Bootstrap UCL	174.7	95% Bootstrap t UCL	527
95% H-UCL (Log ROS)	100.9		

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242) (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.328	KM Geo Mean	27.88
KM SD (logged)	0.915	95% Critical H Value (KM-Log)	2.417
KM Standard Error of Mean (logged)	0.272	95% H-UCL (KM -Log)	67.89
KM SD (logged)	0.915	95% Critical H Value (KM-Log)	2.417
KM Standard Error of Mean (logged)	0.272		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	72.67	Mean in Log Scale	3.161
SD in Original Scale	171.9	SD in Log Scale	1.164
95% t UCL (Assumes normality)	134.2	95% H-Stat UCL	91.87

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	279.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	33	Number of Distinct Observations	22
Number of Detects	3	Number of Non-Detects	30
Number of Distinct Detects	3	Number of Distinct Non-Detects	19
Minimum Detect	360	Minimum Non-Detect	19
Maximum Detect	4200	Maximum Non-Detect	410
Variance Detects	4695600	Percent Non-Detects	90.91%
Mean Detects	1700	SD Detects	2167
Median Detects	540	CV Detects	1.275
Skewness Detects	1.719	Kurtosis Detects	N/A
Mean of Logged Detects	6.84	SD of Logged Detects	1.317

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.37	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	172.2	KM Standard Error of Mean	153.5
KM SD	719.8	95% KM (BCA) UCL	N/A
95% KM (t) UCL	432.1	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	424.6	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	632.6	95% KM Chebyshev UCL	841.2
97.5% KM Chebyshev UCL	1131	99% KM Chebyshev UCL	1699

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.969	k star (bias corrected MLE)	N/A
Theta hat (MLE)	1755	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	5.811	nu star (bias corrected)	N/A
Mean (detects)	1700		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	154.6
Maximum	4200	Median	0.01
SD	734.7	CV	4.754
k hat (MLE)	0.095	k star (bias corrected MLE)	0.107
Theta hat (MLE)	1627	Theta star (bias corrected MLE)	1451
nu hat (MLE)	6.269	nu star (bias corrected)	7.032
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (7.03, α)	2.188	Adjusted Chi Square Value (7.03, β)	2.052
95% Gamma Approximate UCL (use when n>=50)	496.7	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	172.2	SD (KM)	719.8
Variance (KM)	518128	SE of Mean (KM)	153.5
k hat (KM)	0.0572	k star (KM)	0.0722
nu hat (KM)	3.776	nu star (KM)	4.766
theta hat (KM)	3010	theta star (KM)	2384
80% gamma percentile (KM)	66.17	90% gamma percentile (KM)	380.4
95% gamma percentile (KM)	993.7	99% gamma percentile (KM)	3198

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.77, α)	1.046	Adjusted Chi Square Value (4.77, β)	0.961
95% Gamma Approximate KM-UCL (use when n>=50)	784.8	95% Gamma Adjusted KM-UCL (use when n<50)	854

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.328	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	156.2	Mean in Log Scale	0.135
SD in Original Scale	734.3	SD in Log Scale	2.637
95% t UCL (assumes normality of ROS data)	372.8	95% Percentile Bootstrap UCL	405.3
95% BCA Bootstrap UCL	543.1	95% Bootstrap t UCL	1844
95% H-UCL (Log ROS)	356.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.302	KM Geo Mean	27.16
KM SD (logged)	1.169	95% Critical H Value (KM-Log)	2.65
KM Standard Error of Mean (logged)	0.25	95% H-UCL (KM -Log)	92.95
KM SD (logged)	1.169	95% Critical H Value (KM-Log)	2.65
KM Standard Error of Mean (logged)	0.25		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	182	Mean in Log Scale	3.444
SD in Original Scale	729.6	SD in Log Scale	1.314
95% t UCL (Assumes normality)	397.1	95% H-Stat UCL	143.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	432.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	23	Number of Distinct Observations	20
Number of Detects	13	Number of Non-Detects	10
Number of Distinct Detects	13	Number of Distinct Non-Detects	9
Minimum Detect	28	Minimum Non-Detect	16
Maximum Detect	29000	Maximum Non-Detect	53
Variance Detects	63491923	Percent Non-Detects	43.48%
Mean Detects	2505	SD Detects	7968
Median Detects	130	CV Detects	3.181
Skewness Detects	3.594	Kurtosis Detects	12.94
Mean of Logged Detects	5.473	SD of Logged Detects	1.813

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.343	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.493	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1424	KM Standard Error of Mean	1277
KM SD	5886	95% KM (BCA) UCL	3962
95% KM (t) UCL	3617	95% KM (Percentile Bootstrap) UCL	3899
95% KM (z) UCL	3525	95% KM Bootstrap t UCL	39718
90% KM Chebyshev UCL	5256	95% KM Chebyshev UCL	6992
97.5% KM Chebyshev UCL	9401	99% KM Chebyshev UCL	14134

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.177	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.832	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.331	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.257	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.294	k star (bias corrected MLE)	0.277
Theta hat (MLE)	8519	Theta star (bias corrected MLE)	9028
nu hat (MLE)	7.645	nu star (bias corrected)	7.214
Mean (detects)	2505		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1416
Maximum	29000	Median	52
SD	6020	CV	4.252
k hat (MLE)	0.128	k star (bias corrected MLE)	0.14
Theta hat (MLE)	11098	Theta star (bias corrected MLE)	10119
nu hat (MLE)	5.869	nu star (bias corrected)	6.436
Adjusted Level of Significance (β)	0.0389		
Approximate Chi Square Value (6.44, α)	1.867	Adjusted Chi Square Value (6.44, β)	1.694
95% Gamma Approximate UCL (use when n>=50)	4882	95% Gamma Adjusted UCL (use when n<50)	5378

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1424	SD (KM)	5886
Variance (KM)	34645636	SE of Mean (KM)	1277
k hat (KM)	0.0585	k star (KM)	0.0799
nu hat (KM)	2.692	nu star (KM)	3.674
theta hat (KM)	24333	theta star (KM)	17827
80% gamma percentile (KM)	675.5	90% gamma percentile (KM)	3372
95% gamma percentile (KM)	8279	99% gamma percentile (KM)	25237

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.67, α)	0.597	Adjusted Chi Square Value (3.67, β)	0.518
95% Gamma Approximate KM-UCL (use when n>=50)	8758	95% Gamma Adjusted KM-UCL (use when n<50)	10094

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.854	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.191	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1417	Mean in Log Scale	3.612
SD in Original Scale	6020	SD in Log Scale	2.568
95% t UCL (assumes normality of ROS data)	3573	95% Percentile Bootstrap UCL	3887
95% BCA Bootstrap UCL	5215	95% Bootstrap t UCL	44203
95% H-UCL (Log ROS)	15634		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.346	KM Geo Mean	77.14
KM SD (logged)	1.842	95% Critical H Value (KM-Log)	3.791
KM Standard Error of Mean (logged)	0.403	95% H-UCL (KM -Log)	1864
KM SD (logged)	1.842	95% Critical H Value (KM-Log)	3.791
KM Standard Error of Mean (logged)	0.403		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1424	Mean in Log Scale	4.331
SD in Original Scale	6018	SD in Log Scale	1.903
95% t UCL (Assumes normality)	3579	95% H-Stat UCL	2251

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	6992

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260)

General Statistics

Total Number of Observations	33	Number of Distinct Observations	26
Number of Detects	9	Number of Non-Detects	24
Number of Distinct Detects	9	Number of Distinct Non-Detects	18
Minimum Detect	23	Minimum Non-Detect	20
Maximum Detect	2800	Maximum Non-Detect	430
Variance Detects	796505	Percent Non-Detects	72.73%
Mean Detects	785.9	SD Detects	892.5
Median Detects	460	CV Detects	1.136
Skewness Detects	1.664	Kurtosis Detects	2.759
Mean of Logged Detects	5.956	SD of Logged Detects	1.462

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.814	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	230.5	KM Standard Error of Mean	102.7
KM SD	555.8	95% KM (BCA) UCL	420.1
95% KM (t) UCL	404.4	95% KM (Percentile Bootstrap) UCL	415.8
95% KM (z) UCL	399.4	95% KM Bootstrap t UCL	561.5
90% KM Chebyshev UCL	538.5	95% KM Chebyshev UCL	678
97.5% KM Chebyshev UCL	871.6	99% KM Chebyshev UCL	1252

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.138	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.121	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.289	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.831	k star (bias corrected MLE)	0.628
Theta hat (MLE)	945.9	Theta star (bias corrected MLE)	1251
nu hat (MLE)	14.96	nu star (bias corrected)	11.3
Mean (detects)	785.9		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	214.3
Maximum	2800	Median	0.01
SD	570.5	CV	2.662
k hat (MLE)	0.113	k star (bias corrected MLE)	0.123
Theta hat (MLE)	1901	Theta star (bias corrected MLE)	1747
nu hat (MLE)	7.441	nu star (bias corrected)	8.098
Adjusted Level of Significance (β)	0.0419		
Approximate Chi Square Value (8.10, α)	2.792	Adjusted Chi Square Value (8.10, β)	2.634
95% Gamma Approximate UCL (use when n>=50)	621.7	95% Gamma Adjusted UCL (use when n<50)	659.1

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	230.5	SD (KM)	555.8
Variance (KM)	308964	SE of Mean (KM)	102.7
k hat (KM)	0.172	k star (KM)	0.177
nu hat (KM)	11.35	nu star (KM)	11.65
theta hat (KM)	1340	theta star (KM)	1306
80% gamma percentile (KM)	282.4	90% gamma percentile (KM)	694.4
95% gamma percentile (KM)	1225	99% gamma percentile (KM)	2717

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.65, α)	4.997	Adjusted Chi Square Value (11.65, β)	4.774
95% Gamma Approximate KM-UCL (use when n>=50)	537.3	95% Gamma Adjusted KM-UCL (use when n<50)	562.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.114	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	218.3	Mean in Log Scale	2.612
SD in Original Scale	569	SD in Log Scale	2.32
95% t UCL (assumes normality of ROS data)	386.1	95% Percentile Bootstrap UCL	388.5
95% BCA Bootstrap UCL	472	95% Bootstrap t UCL	571.4
95% H-UCL (Log ROS)	1195		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.837	KM Geo Mean	46.39
KM SD (logged)	1.497	95% Critical H Value (KM-Log)	3.101
KM Standard Error of Mean (logged)	0.28	95% H-UCL (KM -Log)	323.4
KM SD (logged)	1.497	95% Critical H Value (KM-Log)	3.101
KM Standard Error of Mean (logged)	0.28		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	241.3	Mean in Log Scale	3.924
SD in Original Scale	561.6	SD in Log Scale	1.636
95% t UCL (Assumes normality)	406.9	95% H-Stat UCL	501.6

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	404.4

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysotile asbestos

General Statistics

Total Number of Observations	11	Number of Distinct Observations	2
Number of Detects	3	Number of Non-Detects	8
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.25	Minimum Non-Detect	0.25
Maximum Detect	0.5	Maximum Non-Detect	0.25
Variance Detects	0.0208	Percent Non-Detects	72.73%
Mean Detects	0.333	SD Detects	0.144
Median Detects	0.25	CV Detects	0.433
Skewness Detects	1.732	Kurtosis Detects	N/A
Mean of Logged Detects	-1.155	SD of Logged Detects	0.4

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.273	KM Standard Error of Mean	0.0265
KM SD	0.0719	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.321	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.316	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.352	95% KM Chebyshev UCL	0.388
97.5% KM Chebyshev UCL	0.438	99% KM Chebyshev UCL	0.537

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	8.992	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0371	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	53.95	nu star (bias corrected)	N/A
Mean (detects)	0.333		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.102
Maximum	0.5	Median	0.01
SD	0.162	CV	1.594
k hat (MLE)	0.513	k star (bias corrected MLE)	0.434
Theta hat (MLE)	0.199	Theta star (bias corrected MLE)	0.235
nu hat (MLE)	11.29	nu star (bias corrected)	9.546
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (9.55, α)	3.66	Adjusted Chi Square Value (9.55, β)	3.09
95% Gamma Approximate UCL (use when n>=50)	0.266	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.16.2

Summary of ProUCL Output for EU18-EU19 Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 11:42:16 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysotile asbestos (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.273	SD (KM)	0.0719
Variance (KM)	0.00517	SE of Mean (KM)	0.0265
k hat (KM)	14.4	k star (KM)	10.53
nu hat (KM)	316.8	nu star (KM)	231.7
theta hat (KM)	0.0189	theta star (KM)	0.0259
80% gamma percentile (KM)	0.34	90% gamma percentile (KM)	0.384
95% gamma percentile (KM)	0.424	99% gamma percentile (KM)	0.505

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (231.73, α)	197.5	Adjusted Chi Square Value (231.73, β)	192.3
95% Gamma Approximate KM-UCL (use when n>=50)	0.32	95% Gamma Adjusted KM-UCL (use when n<50)	0.329

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.141	Mean in Log Scale	-2.388
SD in Original Scale	0.143	SD in Log Scale	0.98
95% t UCL (assumes normality of ROS data)	0.219	95% Percentile Bootstrap UCL	0.212
95% BCA Bootstrap UCL	0.23	95% Bootstrap t UCL	0.273
95% H-UCL (Log ROS)	0.371		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.323	KM Geo Mean	0.266
KM SD (logged)	0.199	95% Critical H Value (KM-Log)	1.859
KM Standard Error of Mean (logged)	0.0736	95% H-UCL (KM -Log)	0.305
KM SD (logged)	0.199	95% Critical H Value (KM-Log)	1.859
KM Standard Error of Mean (logged)	0.0736		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.182	Mean in Log Scale	-1.827
SD in Original Scale	0.117	SD in Log Scale	0.467
95% t UCL (Assumes normality)	0.246	95% H-Stat UCL	0.246

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.321

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11	12	13
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene
on-site (EU18)	S2(EPA)	10/23/1990	0-1 ft BGS					74	1	140	1	280	1			330	0
on-site (EU18)	S03(OEPA)	7/9/1996	1.5-2 ft BGS	12	0	410	0	410	0	410	0	410	0	410	0	410	0
on-site (EU18)	SS-26	10/26/2018	0-2 ft BGS					1500	1	1500	1	2600	1	77	1	410	1
on-site (EU18)	SS-27	10/26/2018	0-2 ft BGS	0.72	0			11	1	10	0	12	1	21	0	7.7	0
on-site (EU18)	SS-28	10/26/2018	0-2 ft BGS	0.74	0	0.94	0	11	1	14	1	18	1	24	0	8.6	0
on-site (EU18)	SS-33	10/26/2018	0.17-2.17 ft BGS	1.3	0			6900	1	6000	1	8500	1	870	1	1200	1
on-site (EU18)	SS-34	10/26/2018	0-2 ft BGS	1.8	0			260	1	220	1	330	1	52	1	58	1
on-site (EU18)	SS-105	10/26/2018	0-2 ft BGS														
on-site (EU18)	SS-179-AS	10/26/2018	0-0.5 ft BGS														
on-site (EU18)	SS-180-AS	10/26/2018	0.17-0.67 ft BGS														
on-site (EU19)	BH75-13	6/25/2013	0-2 ft BGS	560	1	970	0										
on-site (EU19)	BH76-13	6/25/2013	8-10 ft BGS	260	0	260	0										
on-site (EU19)	BH79-13	6/26/2013	4-6 ft BGS	280	0	280	0										
on-site (EU19)	BH85-13	6/25/2013	8-10 ft BGS	460	0	460	0										
on-site (EU19)	BH93-13	6/28/2013	13-15 ft BGS	8.2	0												
on-site (EU19)	BH94-17	12/20/2017	13-14.8 ft BGS	0.34	0	0.36	0	110	1	93	1	150	1	32	0	28	1
on-site (EU19)	BH95-17	12/19/2017	5-7 ft BGS	67	1	38	0	2100	1	1600	1	2100	1	330	1	270	1
on-site (EU19)	BH96-18	1/3/2018	13-15 ft BGS	0.3	0	0.31	0	59	1	21	1	48	1	150	0	3.7	0
on-site (EU19)	BH164-17	12/20/2017	13-15 ft BGS														
on-site (EU19)	BH165-17	12/20/2017	13-15 ft BGS														
on-site (EU19)	BH166-17	12/19/2017	1-3 ft BGS														
on-site (EU19)	BH168-17	12/21/2017	12.5-14.5 ft BGS														
on-site (EU19)	BH172-17	12/8/2017	12-14 ft BGS														
on-site (EU19)	BH173-17	12/21/2017	5-7 ft BGS														
on-site (EU19)	GP26-18	1/29/2018	13.5-14.5 ft bgs	0.36	0	0.39	0										
on-site (EU19)	GP27-18	1/30/2018	7-8 ft bgs	45	0	2900	1										
on-site (EU19)	GP29-18	1/30/2018	9-10 ft bgs	0.33	0	0.35	0										
on-site (EU19)	S1(EPA)	10/23/1990	1-2 ft BGS					310	1	230	1	230	1			330	0
on-site (EU19)	S3(EPA)	10/23/1990	0-1 ft BGS					8500	1	5700	1	9500	1			1200	1
on-site (EU19)	S4(EPA)	10/23/1990	0-1 ft BGS					330	0	330	0	330	0			330	0
on-site (EU19)	S5(EPA)	10/23/1990	1-2 ft BGS					170	1	150	1	320	1			330	0
on-site (EU19)	S6(EPA)	10/23/1990	0-1 ft BGS					6900	1	4800	1	7800	1			1600	1
on-site (EU19)	S7(EPA)	10/23/1990	0-1 ft BGS					1100	1	1100	1	2900	1			230	1
on-site (EU19)	S8(EPA)	10/23/1990	0-1 ft BGS					330	0	150	1	230	1			330	0
on-site (EU19)	S9(EPA)	10/23/1990	0-1 ft BGS					330	0	330	0	150	1			330	0
on-site (EU19)	S11(EPA)	10/23/1990	0-1 ft BGS					430	1	220	1	630	1			330	0
on-site (EU19)	S01(OEPA)	7/9/1996	4-4.6 ft BGS	12	0	140	1	410	0	410	0	410	0	410	0	410	0
on-site (EU19)	S02(OEPA)	7/9/1996	0-0.1 ft BGS	10	0	340	0	340	0	340	0	340	0	340	0	340	0
on-site (EU19)	S04(OEPA)	7/9/1996	1.5-2 ft BGS	16	0	520	0	41	1	520	0	520	0	520	0	520	0
on-site (EU19)	S06(OEPA)	7/9/1996	1.5-2.5 ft BGS	16	0	530	0	530	0	530	0	530	0	530	0	530	0
on-site (EU19)	S09(OEPA)	7/9/1996	0.3-0.5 ft BGS	11	0	350	0	180	1	110	1	320	1	350	0	350	0
on-site (EU19)	S10(OEPA)	7/9/1996	0-0.3 ft BGS	12	0	400	0	51	1	400	0	79	1	400	0	400	0
on-site (EU19)	S11(OEPA)	7/9/1996	0.2-0.3 ft BGS	11	0	360	0	950	1	1000	1	1300	1	38	1	450	1
on-site (EU19)	SS-20	10/31/2017	0-2 ft BGS					200	1	140	1	330	1	79	0	1.9	0
on-site (EU19)	SS-21	11/19/2018	0-2 ft BGS	1.1	0			480	1	470	1	960	1	59	1	94	1
on-site (EU19)	SS-22	11/7/2017	0-2 ft BGS	0.61	0	0.64	0	170	1	140	1	220	1	180	0	4.3	0
on-site (EU19)	SS-23	11/19/2018	0-2 ft BGS	0.94	0	1.2	0	260	1	230	1	400	1	36	1	50	1
on-site (EU19)	SS-24	11/7/2017	0-2 ft BGS	0.83	0	0.88	0	850	1	1000	1	1500	1	130	0	210	1
on-site (EU19)	SS-29	10/31/2017	0-2 ft BGS	0.91	0			120	1	110	1	240	1	38	0	0.93	0
on-site (EU19)	SS-30	11/2/2017	0-2 ft BGS	0.36	0	0.38	0	220	1	210	1	350	1	31	0	0.77	0
on-site (EU19)	SS-31	11/2/2017	0-2 ft BGS	0.49	0	0.52	0	23	1	23	1	33	1	30	0	0.74	0
on-site (EU19)	SS-35	10/30/2017	0-2 ft BGS	0.39	0	0.42	0	430	1	530	1	560	1	30	1	110	1
on-site (EU19)	SS-36	10/31/2017	0-2 ft BGS	0.44	0	0.47	0	160	1	180	1	340	1	29	0	0.72	0
on-site (EU19)	SS-106	11/19/2018	0-2 ft BGS														
on-site (EU19)	SS-107	11/19/2018	0-2 ft BGS														
on-site (EU19)	SS-108 (SS-22/TT-32)	11/16/2018	0-2 ft BGS														
on-site (EU19)	SS-110 (SS-31/TT39)	11/19/2018	0-2 ft BGS														
on-site (EU19)	SS-111 (SS-30/TT-38)	11/16/2018	0-2 ft BGS														
on-site (EU19)	SS-113 (SS-35/TP-15)	11/16/2018	0-2 ft BGS														
on-site (EU19)	SS-181-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-182-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-183-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-184-AS	11/16/2018	0-0.5 ft BGS														

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11	12	13
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	1,1-Dichloroethane	D_1,1-Dichloroethane	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene
on-site (EU19)	SS-185-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-186-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-187-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-188-AS	10/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-189-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-190-AS	11/19/2018	0-0.5 ft BGS														
on-site (EU19)	SS-191-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	SS-192-AS	11/16/2018	0-0.5 ft BGS														
on-site (EU19)	TP-1	9/23/2008	13 ft BGS	6	0	0.87	0							60	0		
on-site (EU19)	TP-1	9/23/2008	13 ft BGS					140	1	140	1	180	1			22	1
on-site (EU19)	TP-1	9/23/2008	4 ft BGS	5.2	0	5.2	0							22	1		
on-site (EU19)	TP-1	9/23/2008	4 ft BGS					1100	1	980	1	1800	1			270	
on-site (EU19)	TP-1	9/23/2008	6 ft BGS	6.2	0	6.2	0	7.5	0	7.5	0	7.5	0	57	0	7.5	0
on-site (EU19)	TP-1	9/23/2008	6 ft BGS														
on-site (EU19)	TP-1	9/23/2008	8 ft BGS	7	0	7	0	8.6	0	8.6	0	8.6	0	65	0	8.6	0
on-site (EU19)	TP-1	9/23/2008	8 ft BGS														
on-site (EU19)	TP-2	9/24/2008	1 ft BGS	4.8	0	4.8	0							55	0	7.3	0
on-site (EU19)	TP-2	9/24/2008	1 ft BGS					33	1	35	1	46	1				
on-site (EU19)	TP-2	9/24/2008	5 ft BGS	8.5	0	2	1	11	0	11	0	11	0	79	0	11	0
on-site (EU19)	TP-2	9/24/2008	5 ft BGS														
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS	220	1	390	0	190	0	190	0	190	0	1400	0	190	0
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS														
on-site (EU19)	TP-3	9/24/2008	13.5 ft BGS														
on-site (EU19)	TP-3	9/24/2008	4 ft BGS	4.9	0	4.9	0							31	1		
on-site (EU19)	TP-3	9/24/2008	4- ft BGS					160	1	120	1	180	1			23	1
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS	320	0	320	0							1400	0	190	0
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS					490	1	320	1	530	1				
on-site (EU19)	TP-4	9/24/2008	10 ft BGS	11	0	11	0							56	0	7.5	0
on-site (EU19)	TP-4	9/24/2008	10 ft BGS					100	1	44	1	110	1				
on-site (EU19)	TP-4	9/24/2008	5 ft BGS	11	0	11	0							55	0	7.3	0
on-site (EU19)	TP-4	9/24/2008	5 ft BGS					16	1	13	1	21	1				
on-site (EU19)	TP-11	10/31/2017	8-10 ft BGS	0.57	0			1100	1	1000	1	1400	1	290	0	230	1
on-site (EU19)	TP-12	11/1/2017	8-10 ft BGS	267.5	1	31	0	450	1	52	0	48	0	2200	0	53.5	0
on-site (EU19)	TP-14	10/31/2017	8-10 ft BGS	0.56	0			61	1	46	1	72	1	33	0	15	1
on-site (EU19)	TP-15	10/30/2017	10-12 ft BGS					130	1	120	1	170	1	32	0	26	1
on-site (EU19)	TP-16	10/31/2017	4-6 ft BGS	0.43	0	0.45	0	86	1	97	1	170	1	29	0	0.7	0
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS	4.9	0	4.9	0	77	0	77	0	77	0	575	0	77	0
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS														
on-site (EU19)	TT-31	11/7/2017	14-15 ft BGS	33	1	0.71	0	230	1	230	1	510	1	67	0	76	1
on-site (EU19)	TT-31	11/7/2017	8-10 ft BGS														
on-site (EU19)	TT-32	11/7/2017	12-14 ft BGS	0.57	0	0.61	0	770	1	810	1	1100	1	160	0	210	1
on-site (EU19)	TT-33	11/3/2017	12-14 ft BGS	390	1	41	0	130	1	130	1	150	1	320	0	7.8	0
on-site (EU19)	TT-33	11/3/2017	2-4 ft BGS														
on-site (EU19)	TT-34	11/7/2017	8-10 ft BGS	0.83	0	0.88	0	930	1	950	1	1300	1	140	0	220	1
on-site (EU19)	TT-35	11/6/2017	12-14 ft BGS	0.71	0	0.75	0	86	1	71	1	110	1	130	0	3.2	0
on-site (EU19)	TT-36	11/6/2017	2-4 ft BGS	60	0	12000	1	430	1	230	1	350	1	840	0	20	0
on-site (EU19)	TT-36	11/6/2017	8-10 ft BGS														
on-site (EU19)	TT-37	11/6/2017	4-6 ft BGS														
on-site (EU19)	TT-37	11/6/2017	8-10 ft BGS	0.65	0			250	1	180	1	310	1	79	0	1.9	0
on-site (EU19)	TT-38	11/2/2017	2-4 ft BGS														
on-site (EU19)	TT-39	11/2/2017	8-10 ft BGS	0.49	0	0.52	0	270	1	210	1	290	1	32	0	38	1

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)
on-site (EU18)	S2(EPA)	10/23/1990	0-1 ft BGS	330	0	3800	1	2.4	0	6.8	1	23.28	1	1	0	2.4	1	10	0	48.9	1	
on-site (EU18)	S03(OEPA)	7/9/1996	1.5-2 ft BGS	410	0	1525	1	0.82	0	1.6	1	9.7	1	0.43	1	1.85	1	1.7	1	116.45	1	0.205
on-site (EU18)	SS-26	10/26/2018	0-2 ft BGS	1300	1	7500	1	1.6	1	41	1	310	1	0.76	1	0.91	1	16	1	85	1	0.54
on-site (EU18)	SS-27	10/26/2018	0-2 ft BGS	8.2	0	1200	1	0.57	1	3.8	1	6.3	1	0.13	1	0.56	1	4.3	1	88	1	0.23
on-site (EU18)	SS-28	10/26/2018	0-2 ft BGS	9.2	0	1500	1	0.21	1	3	1	9.2	1	1.2	1	0.3	0	2.1	1	34	1	0.24
on-site (EU18)	SS-33	10/26/2018	0.17-2.17 ft BGS	3800	1	6600	1	3.4	1	17	1	220	1	1.1	1	0.36	0	8.9	1	210	1	0.31
on-site (EU18)	SS-34	10/26/2018	0-2 ft BGS	160	1	7600	1	1.4	1	28	1	220	1	0.68	1	2.5	0	9.7	1	81	1	0.94
on-site (EU18)	SS-105	10/26/2018	0-2 ft BGS																			
on-site (EU18)	SS-179-AS	10/26/2018	0-0.5 ft BGS																			
on-site (EU18)	SS-180-AS	10/26/2018	0.17-0.67 ft BGS																			
on-site (EU19)	BH75-13	6/25/2013	0-2 ft BGS																			
on-site (EU19)	BH76-13	6/25/2013	8-10 ft BGS																			
on-site (EU19)	BH79-13	6/26/2013	4-6 ft BGS																			
on-site (EU19)	BH85-13	6/25/2013	8-10 ft BGS																			
on-site (EU19)	BH93-13	6/28/2013	13-15 ft BGS																			
on-site (EU19)	BH94-17	12/20/2017	13-14.8 ft BGS	61	1	2800	1	0.68	1	5.8	1	310	1	1.1	1	0.28	0	4.3	1	41	1	0.14
on-site (EU19)	BH95-17	12/19/2017	5-7 ft BGS	760	1	1200	1	0.55	1	5.5	1	120	1	0.16	1	0.28	0	3.7	1	61	1	0.084
on-site (EU19)	BH96-18	1/3/2018	13-15 ft BGS	1.9	0	2500	1	0.55	1	4.4	1	15	1	2.2	1	0.27	0	3.4	1	110	1	0.14
on-site (EU19)	BH164-17	12/20/2017	13-15 ft BGS													5	1					
on-site (EU19)	BH165-17	12/20/2017	13-15 ft BGS													1.5	0					
on-site (EU19)	BH166-17	12/19/2017	1-3 ft BGS													0.28	0					
on-site (EU19)	BH168-17	12/21/2017	12.5-14.5 ft BGS													2.8	0					
on-site (EU19)	BH172-17	12/8/2017	12-14 ft BGS													0.34	0					
on-site (EU19)	BH173-17	12/21/2017	5-7 ft BGS													2.8	0					
on-site (EU19)	GP26-18	1/29/2018	13.5-14.5 ft bgs																			
on-site (EU19)	GP27-18	1/30/2018	7-8 ft bgs																			
on-site (EU19)	GP29-18	1/30/2018	9-10 ft bgs																			
on-site (EU19)	S1(EPA)	10/23/1990	1-2 ft BGS	96	1	5730	1	2.4	0	23.9	1	991	1	1.3	1	2.6	1	3.7	1	66.8	1	
on-site (EU19)	S3(EPA)	10/23/1990	0-1 ft BGS	5000	1	4740	1	31.6	1	8.3	1	157	1	14	1	13.1	1	5.6	1	2220	1	
on-site (EU19)	S4(EPA)	10/23/1990	0-1 ft BGS	330	0	3360	1	2.4	0	12.6	1	117	1	1	0	0.9	1	8.8	1	56.7	1	
on-site (EU19)	S5(EPA)	10/23/1990	1-2 ft BGS	150	1	1990	1	2.4	0	10.3	1	81	1	1	1	1.6	1	5	1	74.1	1	
on-site (EU19)	S6(EPA)	10/23/1990	0-1 ft BGS	4100	1	4620	1	2.4	0	11.1	1	167	1	1	0	1.2	1	8.2	1	47.4	1	
on-site (EU19)	S7(EPA)	10/23/1990	0-1 ft BGS	910	1	2970	1	13.2	1	8.9	1	130	1	5.9	1	2.9	1	5.2	1	316	1	
on-site (EU19)	S8(EPA)	10/23/1990	0-1 ft BGS	160	1	5350	1	2.4	0	11.6	1	150	1	8.6	1	6.1	1	6.2	1	2200	1	
on-site (EU19)	S9(EPA)	10/23/1990	0-1 ft BGS	330	0	11100	1	2.1	1	69.3	1	190	1	1	0	3.3	1	22.1	1	76.6	1	
on-site (EU19)	S11(EPA)	10/23/1990	0-1 ft BGS	270	1	8460	1	18.2	1	20.1	1	265	1	8.4	1	4.3	1	10.9	1	796	1	
on-site (EU19)	S01(OEPA)	7/9/1996	4-4.6 ft BGS	410	0	3470	1	0.75	0	20.7	1	182	1	0.47	1	0.79	1	6	1	26.8	1	0.27
on-site (EU19)	S02(OEPA)	7/9/1996	0-0.1 ft BGS	340	0	10400	1	0.7	1	77.2	1	272	1	6.6	1	3.4	1	16.2	1	91.8	1	0.26
on-site (EU19)	S04(OEPA)	7/9/1996	1.5-2 ft BGS	520	0	5290	1	1	1	27	1	222	1	0.38	1	2	1	9.6	1	73	1	0.34
on-site (EU19)	S06(OEPA)	7/9/1996	1.5-2.5 ft BGS	530	0	6210	1	1	0	49.7	1	320	1	0.33	0	2.4	1	8.7	1	41.5	1	0.29
on-site (EU19)	S09(OEPA)	7/9/1996	0.3-0.5 ft BGS	120	1	4970	1	2.9	1	36	1	824	1	3.9	1	7.2	1	11.2	1	1680	1	3.7
on-site (EU19)	S10(OEPA)	7/9/1996	0-0.3 ft BGS	400	0	8080	1	8.4	1	15.4	1	318	1	16.3	1	6.2	1	13.8	1	191000	1	0.6
on-site (EU19)	S11(OEPA)	7/9/1996	0.2-0.3 ft BGS	910	1	3290	1	2.1	1	6.6	1	93.8	1	1.4	1	2.7	1	4.3	1	405	1	0.55
on-site (EU19)	SS-20	10/31/2017	0-2 ft BGS	58	1	4700	1	21	1	60	1	440	1	5.3	1	3.4	1	12	1	580	1	0.68
on-site (EU19)	SS-21	11/19/2018	0-2 ft BGS	260	1	4500	1	2.2	1	11	1	150	1	3.5	1	1.5	0	3.9	1	320	1	0.35
on-site (EU19)	SS-22	11/7/2017	0-2 ft BGS	95	1	12000	1	52	1	15	1	750	1	34	1	15.7	1	17	1	3200	1	0.59
on-site (EU19)	SS-23	11/19/2018	0-2 ft BGS	140	1	3900	1	30	1	10	1	270	1	2.2	1	0.6	0	7.3	1	320	1	0.24
on-site (EU19)	SS-24	11/7/2017	0-2 ft BGS	690	1	7600	1	39	1	10	1	190	1	8	1	5	1	7.7	1	750	1	0.51
on-site (EU19)	SS-29	10/31/2017	0-2 ft BGS	47	1	2800	1	0.68	1	4	1	88	1	0.34	1	1.1	1	4.3	1	37	1	0.6
on-site (EU19)	SS-30	11/2/2017	0-2 ft BGS	110	1	7800	1	0.25	0	8	1	56	1	0.27	1	1.9	1	6.4	1	19	1	0.53
on-site (EU19)	SS-31	11/2/2017	0-2 ft BGS	18	1	4700	1	0.17	0	4.4	1	87	1	0.17	0	1.2	1	3.6	1	17	1	0.52
on-site (EU19)	SS-35	10/30/2017	0-2 ft BGS	390	1	7700	1	0.41	1	8.3	1	170	1	0.44	1	2	1	7.2	1	44	1	0.47
on-site (EU19)	SS-36	10/31/2017	0-2 ft BGS	79	1	3400	1	0.24	1	5.4	1	45	1	0.25	1	0.9	1	2.9	1	75	1	0.48
on-site (EU19)	SS-106	11/19/2018	0-2 ft BGS																			
on-site (EU19)	SS-107	11/19/2018	0-2 ft BGS																			
on-site (EU19)	SS-108 (SS-22/TT-32)	11/16/2018	0-2 ft BGS																			
on-site (EU19)	SS-110 (SS-31/TT39)	11/19/2018	0-2 ft BGS																			
on-site (EU19)	SS-111 (SS-30/TT-38)	11/16/2018	0-2 ft BGS																			
on-site (EU19)	SS-113 (SS-35/TP-15)	11/16/2018	0-2 ft BGS																			
on-site (EU19)	SS-181-AS	11/19/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-182-AS	11/19/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-183-AS	11/16/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-184-AS	11/16/2018	0-0.5 ft BGS																			

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Cadmium	D_Cadmium	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Copper	D_Copper	Cyanide (total)
on-site (EU19)	SS-185-AS	11/16/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-186-AS	11/19/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-187-AS	11/16/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-188-AS	10/16/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-189-AS	11/16/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-190-AS	11/19/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-191-AS	11/16/2018	0-0.5 ft BGS																			
on-site (EU19)	SS-192-AS	11/16/2018	0-0.5 ft BGS																			
on-site (EU19)	TP-1	9/23/2008	13 ft BGS																			0.6
on-site (EU19)	TP-1	9/23/2008	13 ft BGS	73	1	5540	1	1.1	1	14.9	1	98.8	1	0.42	1	2.1	1	4.8	1	25.8	1	
on-site (EU19)	TP-1	9/23/2008	4 ft BGS																			0.55
on-site (EU19)	TP-1	9/23/2008	4 ft BGS	850	1	4380	1	0.44	1	5.2	1	49.1	1	0.28	1	1.2	1	2.9	1	22	1	
on-site (EU19)	TP-1	9/23/2008	6 ft BGS	7.5	0																	0.57
on-site (EU19)	TP-1	9/23/2008	6 ft BGS			7780	1	0.78	1	35.4	1	172	1	0.35	1	2.9	1	6.6	1	28	1	
on-site (EU19)	TP-1	9/23/2008	8 ft BGS	8.6	0																	0.65
on-site (EU19)	TP-1	9/23/2008	8 ft BGS			7800	1	4.2	1	43.2	1	215	1	0.39	1	3.1	1	6.4	1	34.5	1	
on-site (EU19)	TP-2	9/24/2008	1 ft BGS					6.6	0													0.55
on-site (EU19)	TP-2	9/24/2008	1 ft BGS	20	1	6250	1			8.3	1	56.7	1	0.29	1	1.4	1	5.1	1	15.8	1	
on-site (EU19)	TP-2	9/24/2008	5 ft BGS	11	0			9.5	0													0.79
on-site (EU19)	TP-2	9/24/2008	5 ft BGS			5620	1			22.6	1	173	1	0.2	1	2.1	1	8.1	1	34.4	1	
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS	190	0																	
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS			3740	1	16.1	1	8.6	1	279	1	4.7	1	4.1	1	7.1	1	4030	1	0.58
on-site (EU19)	TP-3	9/24/2008	13.5 ft BGS																			
on-site (EU19)	TP-3	9/24/2008	4 ft BGS					6.7	0													0.56
on-site (EU19)	TP-3	9/24/2008	4- ft BGS	78	1	4610	1			8.9	1	54.7	1	0.89	1	10.5	1	7.4	1	147	1	
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS	190	0			6.7	0													
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS			4500	1			9.1	1	180	1	6.2	1	8.5	1	6.7	1	446	1	0.2
on-site (EU19)	TP-4	9/24/2008	10 ft BGS					6.8	0													0.56
on-site (EU19)	TP-4	9/24/2008	10 ft BGS	19	1	2210	1			5.5	1	189	1	0.096	1	0.9	1	5.6	1	20.8	1	
on-site (EU19)	TP-4	9/24/2008	5 ft BGS					6.6	0													0.55
on-site (EU19)	TP-4	9/24/2008	5 ft BGS	8.1	1	1050	1			2.4	1	59.4	1	0.069	1	0.36	1	2.4	1	7.9	1	
on-site (EU19)	TP-11	10/31/2017	8-10 ft BGS	650	1	4300	1	2.4	1	15	1	960	1	1.2	1	40	1	10	1	1700	1	0.45
on-site (EU19)	TP-12	11/1/2017	8-10 ft BGS	28.5	0	1850	1	2.75	1	5.75	1	175	1	0.49	1	3.5	1	3.5	1	480	1	0.48
on-site (EU19)	TP-14	10/31/2017	8-10 ft BGS	22	1	5300	1	0.28	1	12	1	120	1	0.21	1	1.6	1	7.1	1	27	1	0.5
on-site (EU19)	TP-15	10/30/2017	10-12 ft BGS	78	1	5800	1	0.37	1	12	1	130	1	5.1	1	1.7	1	5.3	1	72	1	0.53
on-site (EU19)	TP-16	10/31/2017	4-6 ft BGS	37	1	3000	1	0.18	1	4	1	31	1	0.17	1	0.86	1	3.2	1	14	1	0.49
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS	77	0			34.45	0													0.575
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS			3830	1			9.1	1	29.75	1	3.95	1	14.85	1	8.3	1	135.5	1	
on-site (EU19)	TT-31	11/7/2017	14-15 ft BGS	230	1	16000	1	97	1	20	1	2300	1	30	1	24	1	19	1	8600	1	0.57
on-site (EU19)	TT-31	11/7/2017	8-10 ft BGS																			
on-site (EU19)	TT-32	11/7/2017	12-14 ft BGS	620	1	2700	1	3.5	1	6.4	1	150	1	3.8	1	4.9	1	4.8	1	310	1	2.2
on-site (EU19)	TT-33	11/3/2017	12-14 ft BGS	4.2	0	2100	1	0.4	1	8.3	1	43	1	0.29	1	2.7	1	2.4	1	44	1	0.58
on-site (EU19)	TT-33	11/3/2017	2-4 ft BGS																			
on-site (EU19)	TT-34	11/7/2017	8-10 ft BGS	720	1	8200	1	120	1	21	1	230	1	22	1	8.1	1	35	1	2500	1	0.52
on-site (EU19)	TT-35	11/6/2017	12-14 ft BGS	46	1	6900	1	6.3	1	27	1	1300	1	7.9	1	7.9	1	17	1	480	1	0.59
on-site (EU19)	TT-36	11/6/2017	2-4 ft BGS	11	0	6900	1	8.2	1	29	1	1600	1	54	1	54	1	240	1	1300	1	14
on-site (EU19)	TT-36	11/6/2017	8-10 ft BGS																			
on-site (EU19)	TT-37	11/6/2017	4-6 ft BGS																			
on-site (EU19)	TT-37	11/6/2017	8-10 ft BGS	97	1	6400	1	0.78	1	29	1	230	1	3.4	1	1.2	1	8.3	1	180	1	0.53
on-site (EU19)	TT-38	11/2/2017	2-4 ft BGS																			
on-site (EU19)	TT-39	11/2/2017	8-10 ft BGS	130	1	10000	1	0.18	0	7.5	1	130	1	0.29	1	2	1	6.7	1	20	1	0.54

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				33	34	35	36	37	38	39	40	41	42	43
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Lead - coarse fraction	D_Lead - coarse fraction	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)
on-site (EU18)	S2(EPA)	10/23/1990	0-1 ft BGS		18000	1	43	1						
on-site (EU18)	S03(OEPA)	7/9/1996	1.5-2 ft BGS	0	10050	1	11.3	1						
on-site (EU18)	SS-26	10/26/2018	0-2 ft BGS	1	9700	1	84	1						
on-site (EU18)	SS-27	10/26/2018	0-2 ft BGS	0	47000	1	6.4	1						
on-site (EU18)	SS-28	10/26/2018	0-2 ft BGS	0	27000	1	26	1	48	1	260	1	84	1
on-site (EU18)	SS-33	10/26/2018	0.17-2.17 ft BGS	1	13000	1	170	1	200	1	290	1	220	1
on-site (EU18)	SS-34	10/26/2018	0-2 ft BGS	1	17000	1	110	1						
on-site (EU18)	SS-105	10/26/2018	0-2 ft BGS											
on-site (EU18)	SS-179-AS	10/26/2018	0-0.5 ft BGS											
on-site (EU18)	SS-180-AS	10/26/2018	0.17-0.67 ft BGS											
on-site (EU19)	BH75-13	6/25/2013	0-2 ft BGS											
on-site (EU19)	BH76-13	6/25/2013	8-10 ft BGS											
on-site (EU19)	BH79-13	6/26/2013	4-6 ft BGS											
on-site (EU19)	BH85-13	6/25/2013	8-10 ft BGS											
on-site (EU19)	BH93-13	6/28/2013	13-15 ft BGS											
on-site (EU19)	BH94-17	12/20/2017	13-14.8 ft BGS	1	12000	1	570	1						
on-site (EU19)	BH95-17	12/19/2017	5-7 ft BGS	1	3100	1	28	1						
on-site (EU19)	BH96-18	1/3/2018	13-15 ft BGS	1	44000	1	38	1						
on-site (EU19)	BH164-17	12/20/2017	13-15 ft BGS											
on-site (EU19)	BH165-17	12/20/2017	13-15 ft BGS											
on-site (EU19)	BH166-17	12/19/2017	1-3 ft BGS											
on-site (EU19)	BH168-17	12/21/2017	12.5-14.5 ft BGS											
on-site (EU19)	BH172-17	12/8/2017	12-14 ft BGS											
on-site (EU19)	BH173-17	12/21/2017	5-7 ft BGS											
on-site (EU19)	GP26-18	1/29/2018	13.5-14.5 ft bgs											
on-site (EU19)	GP27-18	1/30/2018	7-8 ft bgs											
on-site (EU19)	GP29-18	1/30/2018	9-10 ft bgs											
on-site (EU19)	S1(EPA)	10/23/1990	1-2 ft BGS		15900	1	64.1	1						
on-site (EU19)	S3(EPA)	10/23/1990	0-1 ft BGS		77000	1	3300	1						
on-site (EU19)	S4(EPA)	10/23/1990	0-1 ft BGS		2840	1	10.4	1						
on-site (EU19)	S5(EPA)	10/23/1990	1-2 ft BGS		4230	1	59.3	1						
on-site (EU19)	S6(EPA)	10/23/1990	0-1 ft BGS		5630	1	15.9	1						
on-site (EU19)	S7(EPA)	10/23/1990	0-1 ft BGS		14800	1	474	1						
on-site (EU19)	S8(EPA)	10/23/1990	0-1 ft BGS		48300	1	1590	1						
on-site (EU19)	S9(EPA)	10/23/1990	0-1 ft BGS		11100	1	49.7	1						
on-site (EU19)	S11(EPA)	10/23/1990	0-1 ft BGS		25500	1	811	1						
on-site (EU19)	S01(OEPA)	7/9/1996	4-4.6 ft BGS	1	3240	1	29.9	1						
on-site (EU19)	S02(OEPA)	7/9/1996	0-0.1 ft BGS	1	9430	1	110	1						
on-site (EU19)	S04(OEPA)	7/9/1996	1.5-2 ft BGS	1	5890	1	97	1						
on-site (EU19)	S06(OEPA)	7/9/1996	1.5-2.5 ft BGS	1	3120	1	18.2	1						
on-site (EU19)	S09(OEPA)	7/9/1996	0.3-0.5 ft BGS	1	13800	1	1990	1						
on-site (EU19)	S10(OEPA)	7/9/1996	0-0.3 ft BGS	1	92300	1	12100	1						
on-site (EU19)	S11(OEPA)	7/9/1996	0.2-0.3 ft BGS	1	16000	1	242	1						
on-site (EU19)	SS-20	10/31/2017	0-2 ft BGS	0	9200	1	370	1						
on-site (EU19)	SS-21	11/19/2018	0-2 ft BGS	1	7900	1	210	1						
on-site (EU19)	SS-22	11/7/2017	0-2 ft BGS	0	94000	1	13000	1	6400	1	4200	1	5900	1
on-site (EU19)	SS-23	11/19/2018	0-2 ft BGS	0	19000	1	360	1	240	1	360	1	260	1
on-site (EU19)	SS-24	11/7/2017	0-2 ft BGS	0	32000	1	1900	1						
on-site (EU19)	SS-29	10/31/2017	0-2 ft BGS	0	5900	1	46	1						
on-site (EU19)	SS-30	11/2/2017	0-2 ft BGS	0	16000	1	17	1						
on-site (EU19)	SS-31	11/2/2017	0-2 ft BGS	0	8900	1	53	1	59	1	120	1	70	1
on-site (EU19)	SS-35	10/30/2017	0-2 ft BGS	0	15000	1	120	1						
on-site (EU19)	SS-36	10/31/2017	0-2 ft BGS	0	8200	1	42	1						
on-site (EU19)	SS-106	11/19/2018	0-2 ft BGS											
on-site (EU19)	SS-107	11/19/2018	0-2 ft BGS											
on-site (EU19)	SS-108 (SS-22/TT-32)	11/16/2018	0-2 ft BGS											
on-site (EU19)	SS-110 (SS-31/TT39)	11/19/2018	0-2 ft BGS											
on-site (EU19)	SS-111 (SS-30/TT-38)	11/16/2018	0-2 ft BGS											
on-site (EU19)	SS-113 (SS-35/TP-15)	11/16/2018	0-2 ft BGS											
on-site (EU19)	SS-181-AS	11/19/2018	0-0.5 ft BGS											
on-site (EU19)	SS-182-AS	11/19/2018	0-0.5 ft BGS											
on-site (EU19)	SS-183-AS	11/16/2018	0-0.5 ft BGS											
on-site (EU19)	SS-184-AS	11/16/2018	0-0.5 ft BGS											

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				33	34	35	36	37	38	39	40	41	42	43
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Lead - coarse fraction	D_Lead - coarse fraction	Lead - fine fraction	D_Lead - fine fraction	Lead - total (calculated by fine/coarse fraction)	D_Lead - total (calculated by fine/coarse fraction)
on-site (EU19)	SS-185-AS	11/16/2018	0-0.5 ft BGS											
on-site (EU19)	SS-186-AS	11/19/2018	0-0.5 ft BGS											
on-site (EU19)	SS-187-AS	11/16/2018	0-0.5 ft BGS											
on-site (EU19)	SS-188-AS	10/16/2018	0-0.5 ft BGS											
on-site (EU19)	SS-189-AS	11/16/2018	0-0.5 ft BGS											
on-site (EU19)	SS-190-AS	11/19/2018	0-0.5 ft BGS											
on-site (EU19)	SS-191-AS	11/16/2018	0-0.5 ft BGS											
on-site (EU19)	SS-192-AS	11/16/2018	0-0.5 ft BGS											
on-site (EU19)	TP-1	9/23/2008	13 ft BGS	0										
on-site (EU19)	TP-1	9/23/2008	13 ft BGS		12500	1	17.7	1						
on-site (EU19)	TP-1	9/23/2008	4 ft BGS	0										
on-site (EU19)	TP-1	9/23/2008	4 ft BGS		8520	1	32.2	1						
on-site (EU19)	TP-1	9/23/2008	6 ft BGS	0										
on-site (EU19)	TP-1	9/23/2008	6 ft BGS		13400	1	15.5	1						
on-site (EU19)	TP-1	9/23/2008	8 ft BGS	0										
on-site (EU19)	TP-1	9/23/2008	8 ft BGS		16000	1	23.1	1						
on-site (EU19)	TP-2	9/24/2008	1 ft BGS	0										
on-site (EU19)	TP-2	9/24/2008	1 ft BGS		13500	1	17.3	1						
on-site (EU19)	TP-2	9/24/2008	5 ft BGS	0										
on-site (EU19)	TP-2	9/24/2008	5 ft BGS		4960	1	14.3	1						
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS											
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS	1	33800	1	1390	1						
on-site (EU19)	TP-3	9/24/2008	13.5 ft BGS											
on-site (EU19)	TP-3	9/24/2008	4 ft BGS	0										
on-site (EU19)	TP-3	9/24/2008	4- ft BGS		49400	1	47	1						
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS											
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS	1	36700	1	316	1						
on-site (EU19)	TP-4	9/24/2008	10 ft BGS	0										
on-site (EU19)	TP-4	9/24/2008	10 ft BGS		1860	1	7.6	1						
on-site (EU19)	TP-4	9/24/2008	5 ft BGS	0										
on-site (EU19)	TP-4	9/24/2008	5 ft BGS		2190	1	3.7	1						
on-site (EU19)	TP-11	10/31/2017	8-10 ft BGS	0	31000	1	2000	1						
on-site (EU19)	TP-12	11/1/2017	8-10 ft BGS	0	22500	1	260	1						
on-site (EU19)	TP-14	10/31/2017	8-10 ft BGS	0	9300	1	20	1						
on-site (EU19)	TP-15	10/30/2017	10-12 ft BGS	0	10000	1	180	1						
on-site (EU19)	TP-16	10/31/2017	4-6 ft BGS	0	8400	1	23	1						
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS	0										
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS		100500	1	67.3	1						
on-site (EU19)	TT-31	11/7/2017	14-15 ft BGS	0	58000	1	3500	1						
on-site (EU19)	TT-31	11/7/2017	8-10 ft BGS											
on-site (EU19)	TT-32	11/7/2017	12-14 ft BGS	1	18000	1	440	1						
on-site (EU19)	TT-33	11/3/2017	12-14 ft BGS	0	20000	1	23	1						
on-site (EU19)	TT-33	11/3/2017	2-4 ft BGS											
on-site (EU19)	TT-34	11/7/2017	8-10 ft BGS	0	78000	1	3500	1						
on-site (EU19)	TT-35	11/6/2017	12-14 ft BGS	0	30000	1	590	1						
on-site (EU19)	TT-36	11/6/2017	2-4 ft BGS	1	210000	1	920	1						
on-site (EU19)	TT-36	11/6/2017	8-10 ft BGS											
on-site (EU19)	TT-37	11/6/2017	4-6 ft BGS											
on-site (EU19)	TT-37	11/6/2017	8-10 ft BGS	0	21000	1	79	1						
on-site (EU19)	TT-38	11/2/2017	2-4 ft BGS											
on-site (EU19)	TT-39	11/2/2017	8-10 ft BGS	0	17000	1	47	1						

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)
on-site (EU18)	S2(EPA)	10/23/1990	0-1 ft BGS	344	1	0.008	0	13.9	1	2	0	7.3	1	550	1			4200	1
on-site (EU18)	S03(OEPA)	7/9/1996	1.5-2 ft BGS	346	1	0.135	0	15	1	1.7	1	0.91	1	32	1	41	0	41	0
on-site (EU18)	SS-26	10/26/2018	0-2 ft BGS	120	1	0.097	1	30	1	2.4	1	60	1	160	1	34	0	43	0
on-site (EU18)	SS-27	10/26/2018	0-2 ft BGS	510	1	0.019	0	51	1	0.039	0	2.7	1	18	1	21	0	26	0
on-site (EU18)	SS-28	10/26/2018	0-2 ft BGS	1400	1	0.024	0	22	1	0.054	0	2	1	66	1	23	0	30	0
on-site (EU18)	SS-33	10/26/2018	0.17-2.17 ft BGS	200	1	0.32	1	30	1	0.89	1	27	1	220	1	28	0	35	0
on-site (EU18)	SS-34	10/26/2018	0-2 ft BGS	130	1	0.4	1	42	1	1	1	29	1	160	1	39	0	49	0
on-site (EU18)	SS-105	10/26/2018	0-2 ft BGS																
on-site (EU18)	SS-179-AS	10/26/2018	0-0.5 ft BGS																
on-site (EU18)	SS-180-AS	10/26/2018	0.17-0.67 ft BGS																
on-site (EU19)	BH75-13	6/25/2013	0-2 ft BGS																
on-site (EU19)	BH76-13	6/25/2013	8-10 ft BGS																
on-site (EU19)	BH79-13	6/26/2013	4-6 ft BGS																
on-site (EU19)	BH85-13	6/25/2013	8-10 ft BGS																
on-site (EU19)	BH93-13	6/28/2013	13-15 ft BGS																
on-site (EU19)	BH94-17	12/20/2017	13-14.8 ft BGS	250	1	0.028	1	15	1	0.16	1	9.6	1	14000	1	22	0	28	0
on-site (EU19)	BH95-17	12/19/2017	5-7 ft BGS	40	1	0.037	1	7.1	1	0.12	1	6.6	1	16	1	22	0	28	0
on-site (EU19)	BH96-18	1/3/2018	13-15 ft BGS	1900	1	0.02	0	47	1	0.051	0	5	1	140	1	22	0	27	0
on-site (EU19)	BH164-17	12/20/2017	13-15 ft BGS																
on-site (EU19)	BH165-17	12/20/2017	13-15 ft BGS																
on-site (EU19)	BH166-17	12/19/2017	1-3 ft BGS																
on-site (EU19)	BH168-17	12/21/2017	12.5-14.5 ft BGS																
on-site (EU19)	BH172-17	12/8/2017	12-14 ft BGS																
on-site (EU19)	BH173-17	12/21/2017	5-7 ft BGS																
on-site (EU19)	GP26-18	1/29/2018	13.5-14.5 ft bgs																
on-site (EU19)	GP27-18	1/30/2018	7-8 ft bgs																
on-site (EU19)	GP29-18	1/30/2018	9-10 ft bgs																
on-site (EU19)	S1(EPA)	10/23/1990	1-2 ft BGS	309	1	0.008	0	28.9	1	2	0	18.2	1	112	1			360	1
on-site (EU19)	S3(EPA)	10/23/1990	0-1 ft BGS	437	1	0.31	1	262	1	2	0	33.9	1	2350	1			80	0
on-site (EU19)	S4(EPA)	10/23/1990	0-1 ft BGS	7.2	1	0.008	0	13.6	1	2	0	27.9	1	9.2	1			80	0
on-site (EU19)	S5(EPA)	10/23/1990	1-2 ft BGS	55.2	1	0.008	0	17.2	1	2	0	11.5	1	57.6	1			540	1
on-site (EU19)	S6(EPA)	10/23/1990	0-1 ft BGS	27	1	0.008	0	17.2	1	2	0	28.1	1	14.4	1			80	0
on-site (EU19)	S7(EPA)	10/23/1990	0-1 ft BGS	130	1	0.008	0	94.7	1	2	0	16	1	2210	1			80	0
on-site (EU19)	S8(EPA)	10/23/1990	0-1 ft BGS	272	1	0.008	0	402	1	2	0	27.4	1	1490	1			80	0
on-site (EU19)	S9(EPA)	10/23/1990	0-1 ft BGS	162	1	0.3	1	56.6	1	2	1	69.6	1	75.1	1			80	0
on-site (EU19)	S11(EPA)	10/23/1990	0-1 ft BGS	294	1	0.008	0	65.5	1	0.73	1	35.5	1	480	1			80	0
on-site (EU19)	S01(OEPA)	7/9/1996	4-4.6 ft BGS	98.2	1	0.12	0	10.4	1	1	0	18.3	1	33.7	1	41	0	41	0
on-site (EU19)	S02(OEPA)	7/9/1996	0-0.1 ft BGS	99.1	1	0.48	1	34.6	1	1.8	1	92.6	1	39.4	1	34	0	34	0
on-site (EU19)	S04(OEPA)	7/9/1996	1.5-2 ft BGS	72.8	1	0.14	0	20	1	1.7	1	47.7	1	231	1	52	0	52	0
on-site (EU19)	S06(OEPA)	7/9/1996	1.5-2.5 ft BGS	45.2	1	0.17	0	16.6	1	1.3	0	61.9	1	48	1	53	0	53	0
on-site (EU19)	S09(OEPA)	7/9/1996	0.3-0.5 ft BGS	236	1	0.21	1	85	1	1.5	1	33.6	1	291	1	35	0	35	0
on-site (EU19)	S10(OEPA)	7/9/1996	0-0.3 ft BGS	693	1	0.13	0	139	1	4.5	1	28.1	1	11500	1	40	0	40	0
on-site (EU19)	S11(OEPA)	7/9/1996	0.2-0.3 ft BGS	344	1	0.11	0	24.2	1	1.3	1	15.6	1	159	1	36	0	36	0
on-site (EU19)	SS-20	10/31/2017	0-2 ft BGS	47	1	0.17	1	38	1	1.8	1	44	1	390	1	29	0	25	0
on-site (EU19)	SS-21	11/19/2018	0-2 ft BGS	76	1	0.064	1	36	1	0.13	1	9.1	1	810	1	770	1	150	0
on-site (EU19)	SS-22	11/7/2017	0-2 ft BGS	600	1	0.2	1	120	1	0.41	1	29	1	2800	1	340	1	22	0
on-site (EU19)	SS-23	11/19/2018	0-2 ft BGS	270	1	0.12	1	170	1	0.3	1	21	1	430	1	23	0	30	0
on-site (EU19)	SS-24	11/7/2017	0-2 ft BGS	530	1	0.45	1	94	1	0.2	1	21	1	1200	1	480	0	410	0
on-site (EU19)	SS-29	10/31/2017	0-2 ft BGS	100	1	0.049	1	11	1	0.13	1	12	1	43	1	28	0	24	0
on-site (EU19)	SS-30	11/2/2017	0-2 ft BGS	480	1	0.045	1	15	1	0.19	1	20	1	58	1	23	0	20	0
on-site (EU19)	SS-31	11/2/2017	0-2 ft BGS	360	1	0.3	1	9.7	1	0.12	1	13	1	46	1	23	0	19	0
on-site (EU19)	SS-35	10/30/2017	0-2 ft BGS	620	1	0.052	1	14	1	0.18	1	21	1	110	1	23	0	20	0
on-site (EU19)	SS-36	10/31/2017	0-2 ft BGS	260	1	0.053	1	7.3	1	0.1	1	11	1	86	1	22	0	19	0
on-site (EU19)	SS-106	11/19/2018	0-2 ft BGS																
on-site (EU19)	SS-107	11/19/2018	0-2 ft BGS																
on-site (EU19)	SS-108 (SS-22/TT-32)	11/16/2018	0-2 ft BGS																
on-site (EU19)	SS-110 (SS-31/TT39)	11/19/2018	0-2 ft BGS																
on-site (EU19)	SS-111 (SS-30/TT-38)	11/16/2018	0-2 ft BGS																
on-site (EU19)	SS-113 (SS-35/TP-15)	11/16/2018	0-2 ft BGS																
on-site (EU19)	SS-181-AS	11/19/2018	0-0.5 ft BGS																
on-site (EU19)	SS-182-AS	11/19/2018	0-0.5 ft BGS																
on-site (EU19)	SS-183-AS	11/16/2018	0-0.5 ft BGS																
on-site (EU19)	SS-184-AS	11/16/2018	0-0.5 ft BGS																

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)
on-site (EU19)	SS-185-AS	11/16/2018	0-0.5 ft BGS																
on-site (EU19)	SS-186-AS	11/19/2018	0-0.5 ft BGS																
on-site (EU19)	SS-187-AS	11/16/2018	0-0.5 ft BGS																
on-site (EU19)	SS-188-AS	10/16/2018	0-0.5 ft BGS																
on-site (EU19)	SS-189-AS	11/16/2018	0-0.5 ft BGS																
on-site (EU19)	SS-190-AS	11/19/2018	0-0.5 ft BGS																
on-site (EU19)	SS-191-AS	11/16/2018	0-0.5 ft BGS																
on-site (EU19)	SS-192-AS	11/16/2018	0-0.5 ft BGS																
on-site (EU19)	TP-1	9/23/2008	13 ft BGS													200	0		
on-site (EU19)	TP-1	9/23/2008	13 ft BGS	136	1	0.068	1	11.9	1	1.2	1	30.2	1	40.1	1			2700	1
on-site (EU19)	TP-1	9/23/2008	4 ft BGS													36	0	36	0
on-site (EU19)	TP-1	9/23/2008	4 ft BGS	321	1	0.048	1	9.1	1	0.15	1	10.9	1	60	1				
on-site (EU19)	TP-1	9/23/2008	6 ft BGS													190	0		
on-site (EU19)	TP-1	9/23/2008	6 ft BGS	66.4	1	0.072	1	14.6	1	1.8	1	39.7	1	30.8	1			1000	1
on-site (EU19)	TP-1	9/23/2008	8 ft BGS													210	0		
on-site (EU19)	TP-1	9/23/2008	8 ft BGS	79.3	1	0.054	1	16.3	1	2	1	41.9	1	37.6	1			990	1
on-site (EU19)	TP-2	9/24/2008	1 ft BGS													36	0	36	0
on-site (EU19)	TP-2	9/24/2008	1 ft BGS	445	1	0.079	1	11.8	1	0.17	1	17.1	1	53.7	1				
on-site (EU19)	TP-2	9/24/2008	5 ft BGS													52	0	52	0
on-site (EU19)	TP-2	9/24/2008	5 ft BGS	64	1	0.16	1	16.6	1	0.61	1	48.6	1	20.7	1				
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS							0.7	0					46	0	46	0
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS	222	1	0.089	1	58.5	1			22.5	1	259	1				
on-site (EU19)	TP-3	9/24/2008	13.5 ft BGS																
on-site (EU19)	TP-3	9/24/2008	4 ft BGS													37	0	37	0
on-site (EU19)	TP-3	9/24/2008	4- ft BGS	542	1	0.084	1	46.7	1	0.15	1	16	1	97.6	1				
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS													37	0	37	0
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS	386	1	0.068	1	52.1	1	0.17	1	19.4	1	189	1				
on-site (EU19)	TP-4	9/24/2008	10 ft BGS													37	0	37	0
on-site (EU19)	TP-4	9/24/2008	10 ft BGS	6.9	1	0.058	1	11.3	1	0.27	1	16.6	1	12.7	1				
on-site (EU19)	TP-4	9/24/2008	5 ft BGS			0.11	0			0.11						36	0	36	0
on-site (EU19)	TP-4	9/24/2008	5 ft BGS	36.8	1			4.5	1			6.4	1	7.7	1				
on-site (EU19)	TP-11	10/31/2017	8-10 ft BGS	380	1	0.12	1	120	1	0.43	1	20	1	510	1	21	0	18	0
on-site (EU19)	TP-12	11/1/2017	8-10 ft BGS	175	1	0.0395	1	59.5	1	0.1005	1	10.1	1	170	1	165	0	140.5	0
on-site (EU19)	TP-14	10/31/2017	8-10 ft BGS	140	1	0.15	1	15	1	0.51	1	22	1	37	1	120	0	2700	1
on-site (EU19)	TP-15	10/30/2017	10-12 ft BGS	270	1	0.064	1	20	1	0.4	1	19	1	310	1	24	0	20	0
on-site (EU19)	TP-16	10/31/2017	4-6 ft BGS	280	1	0.039	1	7.5	1	0.098	1	11	1	34	1	21	0	18	0
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS							0.115	0					38	0	38	0
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS	1945	1	0.023	1	81.4	1			12.45	1	391.5	1				
on-site (EU19)	TT-31	11/7/2017	14-15 ft BGS	700	1	0.17	1	150	1	0.19	1	30	1	9000	1	1900	1	110	0
on-site (EU19)	TT-31	11/7/2017	8-10 ft BGS																
on-site (EU19)	TT-32	11/7/2017	12-14 ft BGS	220	1	0.22	1	29	1	0.15	1	10	1	280	1	120	1	100	0
on-site (EU19)	TT-33	11/3/2017	12-14 ft BGS	450	1	0.019	0	15	1	0.11	1	4.5	1	26	1	24	0	20	0
on-site (EU19)	TT-33	11/3/2017	2-4 ft BGS																
on-site (EU19)	TT-34	11/7/2017	8-10 ft BGS	930	1	1.2	1	360	1	0.24	1	21	1	1700	1	12000	0	11000	0
on-site (EU19)	TT-35	11/6/2017	12-14 ft BGS	450	1	0.21	1	73	1	0.93	1	51	1	610	1	51	1	20	0
on-site (EU19)	TT-36	11/6/2017	2-4 ft BGS	1600	1	0.035	1	420	1	0.46	1	36	1	1800	1	620	1	21	0
on-site (EU19)	TT-36	11/6/2017	8-10 ft BGS																
on-site (EU19)	TT-37	11/6/2017	4-6 ft BGS																
on-site (EU19)	TT-37	11/6/2017	8-10 ft BGS	120	1	0.025	0	27	1	0.75	1	23	1	44	1	24	0	20	0
on-site (EU19)	TT-38	11/2/2017	2-4 ft BGS																
on-site (EU19)	TT-39	11/2/2017	8-10 ft BGS	450	1	0.13	1	16	1	0.23	1	23	1	150	1	23	0	19	0

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				60	61	62	63	64	65	66	67
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Aroclor-1260 (PCB-1260)	D_Aroclor-1260 (PCB-1260)	Dieldrin	D_Dieldrin	Chrysotile asbestos	D_Chrysotile asbestos
on-site (EU18)	S2(EPA)	10/23/1990	0-1 ft BGS			2800	1				
on-site (EU18)	S03(OEPA)	7/9/1996	1.5-2 ft BGS	41	0	41	0	4.1	0		
on-site (EU18)	SS-26	10/26/2018	0-2 ft BGS	42	0	200	1	20	0		
on-site (EU18)	SS-27	10/26/2018	0-2 ft BGS	25	0	24	0	12	0		
on-site (EU18)	SS-28	10/26/2018	0-2 ft BGS	28	0	27	0	1.4	0		
on-site (EU18)	SS-33	10/26/2018	0.17-2.17 ft BGS	130	1	32	0	80	0		
on-site (EU18)	SS-34	10/26/2018	0-2 ft BGS	240	1	45	0	2.3	0		
on-site (EU18)	SS-105	10/26/2018	0-2 ft BGS								
on-site (EU18)	SS-179-AS	10/26/2018	0-0.5 ft BGS								
on-site (EU18)	SS-180-AS	10/26/2018	0.17-0.67 ft BGS							0.25	0
on-site (EU19)	BH75-13	6/25/2013	0-2 ft BGS								
on-site (EU19)	BH76-13	6/25/2013	8-10 ft BGS								
on-site (EU19)	BH79-13	6/26/2013	4-6 ft BGS								
on-site (EU19)	BH85-13	6/25/2013	8-10 ft BGS								
on-site (EU19)	BH93-13	6/28/2013	13-15 ft BGS								
on-site (EU19)	BH94-17	12/20/2017	13-14.8 ft BGS	110	1	26	0	1	0		
on-site (EU19)	BH95-17	12/19/2017	5-7 ft BGS	380	1	26	0	5.2	0		
on-site (EU19)	BH96-18	1/3/2018	13-15 ft BGS	26	0	25	0	1	0	1	0
on-site (EU19)	BH164-17	12/20/2017	13-15 ft BGS								
on-site (EU19)	BH165-17	12/20/2017	13-15 ft BGS								
on-site (EU19)	BH166-17	12/19/2017	1-3 ft BGS								
on-site (EU19)	BH168-17	12/21/2017	12.5-14.5 ft BGS								
on-site (EU19)	BH172-17	12/8/2017	12-14 ft BGS								
on-site (EU19)	BH173-17	12/21/2017	5-7 ft BGS								
on-site (EU19)	GP26-18	1/29/2018	13.5-14.5 ft bgs								
on-site (EU19)	GP27-18	1/30/2018	7-8 ft bgs								
on-site (EU19)	GP29-18	1/30/2018	9-10 ft bgs								
on-site (EU19)	S1(EPA)	10/23/1990	1-2 ft BGS			300	1				
on-site (EU19)	S3(EPA)	10/23/1990	0-1 ft BGS			580	1				
on-site (EU19)	S4(EPA)	10/23/1990	0-1 ft BGS			160	0				
on-site (EU19)	S5(EPA)	10/23/1990	1-2 ft BGS			110	1				
on-site (EU19)	S6(EPA)	10/23/1990	0-1 ft BGS			160	0				
on-site (EU19)	S7(EPA)	10/23/1990	0-1 ft BGS			1400	1				
on-site (EU19)	S8(EPA)	10/23/1990	0-1 ft BGS			160	0				
on-site (EU19)	S9(EPA)	10/23/1990	0-1 ft BGS			160	0				
on-site (EU19)	S11(EPA)	10/23/1990	0-1 ft BGS			460	1				
on-site (EU19)	S01(OEPA)	7/9/1996	4-4.6 ft BGS	41	0	41	0	4.1	0		
on-site (EU19)	S02(OEPA)	7/9/1996	0-0.1 ft BGS	34	0	34	0	3.4	0		
on-site (EU19)	S04(OEPA)	7/9/1996	1.5-2 ft BGS	52	0	52	0	5.2	0		
on-site (EU19)	S06(OEPA)	7/9/1996	1.5-2.5 ft BGS	53	0	53	0	5.3	0		
on-site (EU19)	S09(OEPA)	7/9/1996	0.3-0.5 ft BGS	830	1	1200	1	3.5	0		
on-site (EU19)	S10(OEPA)	7/9/1996	0-0.3 ft BGS	170	1	40	0	4	0		
on-site (EU19)	S11(OEPA)	7/9/1996	0.2-0.3 ft BGS	36	0	36	0	3.6	0		
on-site (EU19)	SS-20	10/31/2017	0-2 ft BGS	85	1	26	0	6.5	0		
on-site (EU19)	SS-21	11/19/2018	0-2 ft BGS	1100	1	140	0	27	0		
on-site (EU19)	SS-22	11/7/2017	0-2 ft BGS	660	1	23	0	23	0		
on-site (EU19)	SS-23	11/19/2018	0-2 ft BGS	110	1	27	0	14	0		
on-site (EU19)	SS-24	11/7/2017	0-2 ft BGS	29000	1	430	0	54	0		
on-site (EU19)	SS-29	10/31/2017	0-2 ft BGS	84	1	25	0	6.5	0		
on-site (EU19)	SS-30	11/2/2017	0-2 ft BGS	28	1	21	0	1	0		
on-site (EU19)	SS-31	11/2/2017	0-2 ft BGS	16	0	21	0	5.1	0		
on-site (EU19)	SS-35	10/30/2017	0-2 ft BGS	52	1	21	0	1	0		
on-site (EU19)	SS-36	10/31/2017	0-2 ft BGS	75	1	20	0	0.98	0		
on-site (EU19)	SS-106	11/19/2018	0-2 ft BGS								
on-site (EU19)	SS-107	11/19/2018	0-2 ft BGS								
on-site (EU19)	SS-108 (SS-22/TT-32)	11/16/2018	0-2 ft BGS								
on-site (EU19)	SS-110 (SS-31/TT39)	11/19/2018	0-2 ft BGS								
on-site (EU19)	SS-111 (SS-30/TT-38)	11/16/2018	0-2 ft BGS								
on-site (EU19)	SS-113 (SS-35/TP-15)	11/16/2018	0-2 ft BGS								
on-site (EU19)	SS-181-AS	11/19/2018	0-0.5 ft BGS							0.25	1
on-site (EU19)	SS-182-AS	11/19/2018	0-0.5 ft BGS							0.25	0
on-site (EU19)	SS-183-AS	11/16/2018	0-0.5 ft BGS							0.25	0
on-site (EU19)	SS-184-AS	11/16/2018	0-0.5 ft BGS							0.25	0

Table B.16.3

Summary of ProUCL Input Data for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				60	61	62	63	64	65	66	67
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	Aroclor-1260 (PCB-1260)	D_Aroclor-1260 (PCB-1260)	Dieldrin	D_Dieldrin	Chrysotile asbestos	D_Chrysotile asbestos
on-site (EU19)	SS-185-AS	11/16/2018	0-0.5 ft BGS							0.25	1
on-site (EU19)	SS-186-AS	11/19/2018	0-0.5 ft BGS								
on-site (EU19)	SS-187-AS	11/16/2018	0-0.5 ft BGS							0.25	0
on-site (EU19)	SS-188-AS	10/16/2018	0-0.5 ft BGS							0.5	1
on-site (EU19)	SS-189-AS	11/16/2018	0-0.5 ft BGS							0.25	0
on-site (EU19)	SS-190-AS	11/19/2018	0-0.5 ft BGS							0.25	0
on-site (EU19)	SS-191-AS	11/16/2018	0-0.5 ft BGS								
on-site (EU19)	SS-192-AS	11/16/2018	0-0.5 ft BGS							0.25	0
on-site (EU19)	TP-1	9/23/2008	13 ft BGS	200	0			100	0		
on-site (EU19)	TP-1	9/23/2008	13 ft BGS			270	1				
on-site (EU19)	TP-1	9/23/2008	4 ft BGS	36	0	36	0	93	0		
on-site (EU19)	TP-1	9/23/2008	4 ft BGS								
on-site (EU19)	TP-1	9/23/2008	6 ft BGS	190	0	160	1	96	0		
on-site (EU19)	TP-1	9/23/2008	6 ft BGS								
on-site (EU19)	TP-1	9/23/2008	8 ft BGS	210	0	180	1	110	0		
on-site (EU19)	TP-1	9/23/2008	8 ft BGS								
on-site (EU19)	TP-2	9/24/2008	1 ft BGS	36	0	23	1	9.3	0		
on-site (EU19)	TP-2	9/24/2008	1 ft BGS								
on-site (EU19)	TP-2	9/24/2008	5 ft BGS	52	0	47	1	2.7	0		
on-site (EU19)	TP-2	9/24/2008	5 ft BGS								
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS			46	0	24	0		
on-site (EU19)	TP-3	9/24/2008	10.4 ft BGS	80	1						
on-site (EU19)	TP-3	9/24/2008	13.5 ft BGS								
on-site (EU19)	TP-3	9/24/2008	4 ft BGS	37	0			19	0		
on-site (EU19)	TP-3	9/24/2008	4- ft BGS			86	1				
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS	37	0			95	0		
on-site (EU19)	TP-3	9/24/2008	8.7 ft BGS			110	1				
on-site (EU19)	TP-4	9/24/2008	10 ft BGS	37	0	37	0	24	1		
on-site (EU19)	TP-4	9/24/2008	10 ft BGS								
on-site (EU19)	TP-4	9/24/2008	5 ft BGS	36	0	36	0	37	0		
on-site (EU19)	TP-4	9/24/2008	5 ft BGS								
on-site (EU19)	TP-11	10/31/2017	8-10 ft BGS	290	1	19	0	4.7			
on-site (EU19)	TP-12	11/1/2017	8-10 ft BGS	5450	1	148	0	19.5	0		
on-site (EU19)	TP-14	10/31/2017	8-10 ft BGS	86	0	110	0	11	0		
on-site (EU19)	TP-15	10/30/2017	10-12 ft BGS	28	1	22	0	5.2	0		
on-site (EU19)	TP-16	10/31/2017	4-6 ft BGS	15	0	19	0	0.97	0		
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS	38	0	35	1	39	0		
on-site (EU19)	TT-15	9/25/2008	8.6 ft BGS								
on-site (EU19)	TT-31	11/7/2017	14-15 ft BGS	3800	1	110	0	11	0		
on-site (EU19)	TT-31	11/7/2017	8-10 ft BGS							1	0
on-site (EU19)	TT-32	11/7/2017	12-14 ft BGS	2600	1	110	0	21	0	1	0
on-site (EU19)	TT-33	11/3/2017	12-14 ft BGS	50	1	21	0	11	0		
on-site (EU19)	TT-33	11/3/2017	2-4 ft BGS								
on-site (EU19)	TT-34	11/7/2017	8-10 ft BGS	450000	1	11000	0	560	1	1	0
on-site (EU19)	TT-35	11/6/2017	12-14 ft BGS	300	1	22	0	11	0		
on-site (EU19)	TT-36	11/6/2017	2-4 ft BGS	1000	1	22	0	5.6	0		
on-site (EU19)	TT-36	11/6/2017	8-10 ft BGS								
on-site (EU19)	TT-37	11/6/2017	4-6 ft BGS								
on-site (EU19)	TT-37	11/6/2017	8-10 ft BGS	19	1	21	0	21	0		
on-site (EU19)	TT-38	11/2/2017	2-4 ft BGS								
on-site (EU19)	TT-39	11/2/2017	8-10 ft BGS	16	0	21	0	5.5	0		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	56	Number of Distinct Observations	45
Number of Detects	6	Number of Non-Detects	50
Number of Distinct Detects	6	Number of Distinct Non-Detects	39
Minimum Detect	33	Minimum Non-Detect	0.3
Maximum Detect	560	Maximum Non-Detect	460
Variance Detects	39450	Percent Non-Detects	89.29%
Mean Detects	256.3	SD Detects	198.6
Median Detects	243.8	CV Detects	0.775
Skewness Detects	0.477	Kurtosis Detects	-0.582
Mean of Logged Detects	5.163	SD of Logged Detects	1.089

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.163	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	28.62	KM Standard Error of Mean	14.74
KM SD	99.71	95% KM (BCA) UCL	52.63
95% KM (t) UCL	53.28	95% KM (Percentile Bootstrap) UCL	53.68
95% KM (z) UCL	52.87	95% KM Bootstrap t UCL	56.63
90% KM Chebyshev UCL	72.85	95% KM Chebyshev UCL	92.88
97.5% KM Chebyshev UCL	120.7	99% KM Chebyshev UCL	175.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.266	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.709	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.208	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.338	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.449	k star (bias corrected MLE)	0.836
Theta hat (MLE)	176.8	Theta star (bias corrected MLE)	306.6
nu hat (MLE)	17.39	nu star (bias corrected)	10.03
Mean (detects)	256.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	27.46
Maximum	560	Median	0.01
SD	99.91	CV	3.638
k hat (MLE)	0.116	k star (bias corrected MLE)	0.122
Theta hat (MLE)	236.9	Theta star (bias corrected MLE)	225.8
nu hat (MLE)	12.99	nu star (bias corrected)	13.62
Adjusted Level of Significance (β)	0.0457		
Approximate Chi Square Value (13.62, α)	6.314	Adjusted Chi Square Value (13.62, β)	6.182
95% Gamma Approximate UCL (use when n>=50)	59.26	95% Gamma Adjusted UCL (use when n<50)	60.52

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	28.62	SD (KM)	99.71
Variance (KM)	9942	SE of Mean (KM)	14.74
k hat (KM)	0.0824	k star (KM)	0.0899
nu hat (KM)	9.224	nu star (KM)	10.06
theta hat (KM)	347.4	theta star (KM)	318.5
80% gamma percentile (KM)	16.8	90% gamma percentile (KM)	72.49
95% gamma percentile (KM)	166.7	99% gamma percentile (KM)	479.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.06, α)	3.981	Adjusted Chi Square Value (10.06, β)	3.881
95% Gamma Approximate KM-UCL (use when n>=50)	72.33	95% Gamma Adjusted KM-UCL (use when n<50)	74.21

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	30.08	Mean in Log Scale	1.339
SD in Original Scale	99.2	SD in Log Scale	1.505
95% t UCL (assumes normality of ROS data)	52.26	95% Percentile Bootstrap UCL	54.56
95% BCA Bootstrap UCL	62.95	95% Bootstrap t UCL	79.32
95% H-UCL (Log ROS)	22.02		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.484	KM Geo Mean	0.616
KM SD (logged)	2.037	95% Critical H Value (KM-Log)	3.789
KM Standard Error of Mean (logged)	0.306	95% H-UCL (KM -Log)	13.9
KM SD (logged)	2.037	95% Critical H Value (KM-Log)	3.789
KM Standard Error of Mean (logged)	0.306		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	41.91	Mean in Log Scale	0.996
SD in Original Scale	105.3	SD in Log Scale	2.412
95% t UCL (Assumes normality)	65.45	95% H-Stat UCL	210.3

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	53.28

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,4-Dichlorobenzene

General Statistics

Total Number of Observations	47	Number of Distinct Observations	43
Number of Detects	5	Number of Non-Detects	42
Number of Distinct Detects	5	Number of Distinct Non-Detects	38
Minimum Detect	0.87	Minimum Non-Detect	0.31
Maximum Detect	12000	Maximum Non-Detect	970
Variance Detects	26793004	Percent Non-Detects	89.36%
Mean Detects	3009	SD Detects	5176
Median Detects	140	CV Detects	1.72
Skewness Detects	1.95	Kurtosis Detects	3.784
Mean of Logged Detects	4.572	SD of Logged Detects	4.248

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.702	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.31	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	321.6	KM Standard Error of Mean	289
KM SD	1772	95% KM (BCA) UCL	836.2
95% KM (t) UCL	806.7	95% KM (Percentile Bootstrap) UCL	833
95% KM (z) UCL	797	95% KM Bootstrap t UCL	13567
90% KM Chebyshev UCL	1189	95% KM Chebyshev UCL	1581
97.5% KM Chebyshev UCL	2126	99% KM Chebyshev UCL	3197

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.313	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.771	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.233	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.387	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.212	k star (bias corrected MLE)	0.218
Theta hat (MLE)	14182	Theta star (bias corrected MLE)	13789
nu hat (MLE)	2.121	nu star (bias corrected)	2.182
Mean (detects)	3009		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	320.1
Maximum	12000	Median	0.01
SD	1791	CV	5.597
k hat (MLE)	0.0878	k star (bias corrected MLE)	0.0964
Theta hat (MLE)	3645	Theta star (bias corrected MLE)	3321
nu hat (MLE)	8.254	nu star (bias corrected)	9.06
Adjusted Level of Significance (β)	0.0449		
Approximate Chi Square Value (9.06, α)	3.363	Adjusted Chi Square Value (9.06, β)	3.254
95% Gamma Approximate UCL (use when n>=50)	862.2	95% Gamma Adjusted UCL (use when n<50)	891.2

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,4-Dichlorobenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	321.6	SD (KM)	1772
Variance (KM)	3139920	SE of Mean (KM)	289
k hat (KM)	0.0329	k star (KM)	0.045
nu hat (KM)	3.096	nu star (KM)	4.232
theta hat (KM)	9763	theta star (KM)	7143
80% gamma percentile (KM)	29.39	90% gamma percentile (KM)	423.6
95% gamma percentile (KM)	1639	99% gamma percentile (KM)	7284

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.23, α)	0.815	Adjusted Chi Square Value (4.23, β)	0.771
95% Gamma Approximate KM-UCL (use when n>=50)	1669	95% Gamma Adjusted KM-UCL (use when n<50)	1765

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	320.1	Mean in Log Scale	-9.551
SD in Original Scale	1791	SD in Log Scale	5.327
95% t UCL (assumes normality of ROS data)	758.7	95% Percentile Bootstrap UCL	827.7
95% BCA Bootstrap UCL	1145	95% Bootstrap t UCL	1016204
95% H-UCL (Log ROS)	88228		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.422	KM Geo Mean	0.656
KM SD (logged)	2.221	95% Critical H Value (KM-Log)	3.902
KM Standard Error of Mean (logged)	0.387	95% H-UCL (KM -Log)	27.74
KM SD (logged)	2.221	95% Critical H Value (KM-Log)	3.902
KM Standard Error of Mean (logged)	0.387		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	381.4	Mean in Log Scale	1.85
SD in Original Scale	1783	SD in Log Scale	3.139
95% t UCL (Assumes normality)	818.1	95% H-Stat UCL	9940

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	806.7

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	61	Number of Distinct Observations	46
Number of Detects	49	Number of Non-Detects	12
Number of Distinct Detects	38	Number of Distinct Non-Detects	9
Minimum Detect	11	Minimum Non-Detect	7.5
Maximum Detect	8500	Maximum Non-Detect	530
Variance Detects	3144796	Percent Non-Detects	19.67%
Mean Detects	806.8	SD Detects	1773
Median Detects	220	CV Detects	2.198
Skewness Detects	3.506	Kurtosis Detects	11.77
Mean of Logged Detects	5.473	SD of Logged Detects	1.526

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.453	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.332	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.126	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	664.5	KM Standard Error of Mean	207
KM SD	1600	95% KM (BCA) UCL	1081
95% KM (t) UCL	1010	95% KM (Percentile Bootstrap) UCL	1009
95% KM (z) UCL	1005	95% KM Bootstrap t UCL	1227
90% KM Chebyshev UCL	1285	95% KM Chebyshev UCL	1567
97.5% KM Chebyshev UCL	1957	99% KM Chebyshev UCL	2724

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.576	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.813	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.196	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.134	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.518	k star (bias corrected MLE)	0.5
Theta hat (MLE)	1558	Theta star (bias corrected MLE)	1614
nu hat (MLE)	50.76	nu star (bias corrected)	48.98
Mean (detects)	806.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	649.5
Maximum	8500	Median	160
SD	1618	CV	2.492
k hat (MLE)	0.25	k star (bias corrected MLE)	0.249
Theta hat (MLE)	2595	Theta star (bias corrected MLE)	2609
nu hat (MLE)	30.54	nu star (bias corrected)	30.37
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (30.37, α)	18.78	Adjusted Chi Square Value (30.37, β)	18.56
95% Gamma Approximate UCL (use when n>=50)	1050	95% Gamma Adjusted UCL (use when n<50)	1063

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	664.5	SD (KM)	1600
Variance (KM)	2558925	SE of Mean (KM)	207
k hat (KM)	0.173	k star (KM)	0.175
nu hat (KM)	21.05	nu star (KM)	21.35
theta hat (KM)	3851	theta star (KM)	3797
80% gamma percentile (KM)	809.8	90% gamma percentile (KM)	2001
95% gamma percentile (KM)	3539	99% gamma percentile (KM)	7871

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (21.35, α)	11.85	Adjusted Chi Square Value (21.35, β)	11.68
95% Gamma Approximate KM-UCL (use when n>=50)	1197	95% Gamma Adjusted KM-UCL (use when n<50)	1215

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.947	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0796	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.126	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	660.9	Mean in Log Scale	5.12
SD in Original Scale	1614	SD in Log Scale	1.626
95% t UCL (assumes normality of ROS data)	1006	95% Percentile Bootstrap UCL	1045
95% BCA Bootstrap UCL	1127	95% Bootstrap t UCL	1249
95% H-UCL (Log ROS)	1102		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.109	KM Geo Mean	165.5
KM SD (logged)	1.659	95% Critical H Value (KM-Log)	2.72
KM Standard Error of Mean (logged)	0.224	95% H-UCL (KM -Log)	1174
KM SD (logged)	1.659	95% Critical H Value (KM-Log)	2.72
KM Standard Error of Mean (logged)	0.224		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	672.4	Mean in Log Scale	5.206
SD in Original Scale	1610	SD in Log Scale	1.631
95% t UCL (Assumes normality)	1017	95% H-Stat UCL	1214

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1174

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	61	Number of Distinct Observations	44
Number of Detects	46	Number of Non-Detects	15
Number of Distinct Detects	32	Number of Distinct Non-Detects	13
Minimum Detect	13	Minimum Non-Detect	7.5
Maximum Detect	6000	Maximum Non-Detect	530
Variance Detects	1830321	Percent Non-Detects	24.59%
Mean Detects	691.5	SD Detects	1353
Median Detects	195	CV Detects	1.957
Skewness Detects	3.192	Kurtosis Detects	9.773
Mean of Logged Detects	5.436	SD of Logged Detects	1.461

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.501	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.945	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.308	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.129	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	539.4	KM Standard Error of Mean	154.5
KM SD	1193	95% KM (BCA) UCL	830.8
95% KM (t) UCL	797.5	95% KM (Percentile Bootstrap) UCL	812.1
95% KM (z) UCL	793.5	95% KM Bootstrap t UCL	978
90% KM Chebyshev UCL	1003	95% KM Chebyshev UCL	1213
97.5% KM Chebyshev UCL	1504	99% KM Chebyshev UCL	2077

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.597	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.808	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.265	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.137	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.565	k star (bias corrected MLE)	0.543
Theta hat (MLE)	1223	Theta star (bias corrected MLE)	1274
nu hat (MLE)	52	nu star (bias corrected)	49.94
Mean (detects)	691.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	523.6
Maximum	6000	Median	140
SD	1209	CV	2.308
k hat (MLE)	0.238	k star (bias corrected MLE)	0.237
Theta hat (MLE)	2199	Theta star (bias corrected MLE)	2206
nu hat (MLE)	29.05	nu star (bias corrected)	28.96
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (28.96, α)	17.67	Adjusted Chi Square Value (28.96, β)	17.46
95% Gamma Approximate UCL (use when n>=50)	857.7	95% Gamma Adjusted UCL (use when n<50)	868.2

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	539.4	SD (KM)	1193
Variance (KM)	1422806	SE of Mean (KM)	154.5
k hat (KM)	0.205	k star (KM)	0.205
nu hat (KM)	24.95	nu star (KM)	25.06
theta hat (KM)	2638	theta star (KM)	2626
80% gamma percentile (KM)	720.6	90% gamma percentile (KM)	1632
95% gamma percentile (KM)	2760	99% gamma percentile (KM)	5854

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.06, α)	14.66	Adjusted Chi Square Value (25.06, β)	14.46
95% Gamma Approximate KM-UCL (use when n>=50)	922.3	95% Gamma Adjusted KM-UCL (use when n<50)	934.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.954	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.173	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.129	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	535.9	Mean in Log Scale	4.989
SD in Original Scale	1204	SD in Log Scale	1.582
95% t UCL (assumes normality of ROS data)	793.3	95% Percentile Bootstrap UCL	804.3
95% BCA Bootstrap UCL	860.6	95% Bootstrap t UCL	985.1
95% H-UCL (Log ROS)	877.5		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.95	KM Geo Mean	141.2
KM SD (logged)	1.663	95% Critical H Value (KM-Log)	2.724
KM Standard Error of Mean (logged)	0.226	95% H-UCL (KM -Log)	1010
KM SD (logged)	1.663	95% Critical H Value (KM-Log)	2.724
KM Standard Error of Mean (logged)	0.226		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	551.1	Mean in Log Scale	5.083
SD in Original Scale	1199	SD in Log Scale	1.627
95% t UCL (Assumes normality)	807.5	95% H-Stat UCL	1064

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1010

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	61	Number of Distinct Observations	46
Number of Detects	49	Number of Non-Detects	12
Number of Distinct Detects	39	Number of Distinct Non-Detects	11
Minimum Detect	12	Minimum Non-Detect	7.5
Maximum Detect	9500	Maximum Non-Detect	530
Variance Detects	4275405	Percent Non-Detects	19.67%
Mean Detects	1045	SD Detects	2068
Median Detects	320	CV Detects	1.978
Skewness Detects	3.237	Kurtosis Detects	10.13
Mean of Logged Detects	5.817	SD of Logged Detects	1.512

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.503	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.314	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.126	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	858	KM Standard Error of Mean	242.4
KM SD	1874	95% KM (BCA) UCL	1320
95% KM (t) UCL	1263	95% KM (Percentile Bootstrap) UCL	1293
95% KM (z) UCL	1257	95% KM Bootstrap t UCL	1515
90% KM Chebyshev UCL	1585	95% KM Chebyshev UCL	1915
97.5% KM Chebyshev UCL	2372	99% KM Chebyshev UCL	3270

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.333	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.81	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.217	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.133	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.551	k star (bias corrected MLE)	0.531
Theta hat (MLE)	1897	Theta star (bias corrected MLE)	1969
nu hat (MLE)	54	nu star (bias corrected)	52.03
Mean (detects)	1045		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	840
Maximum	9500	Median	230
SD	1896	CV	2.257
k hat (MLE)	0.249	k star (bias corrected MLE)	0.248
Theta hat (MLE)	3369	Theta star (bias corrected MLE)	3387
nu hat (MLE)	30.42	nu star (bias corrected)	30.26
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (30.26, α)	18.7	Adjusted Chi Square Value (30.26, β)	18.48
95% Gamma Approximate UCL (use when n>=50)	1360	95% Gamma Adjusted UCL (use when n<50)	1376

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	858	SD (KM)	1874
Variance (KM)	3510286	SE of Mean (KM)	242.4
k hat (KM)	0.21	k star (KM)	0.21
nu hat (KM)	25.59	nu star (KM)	25.66
theta hat (KM)	4091	theta star (KM)	4079
80% gamma percentile (KM)	1160	90% gamma percentile (KM)	2595
95% gamma percentile (KM)	4362	99% gamma percentile (KM)	9190

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.66, α)	15.12	Adjusted Chi Square Value (25.66, β)	14.92
95% Gamma Approximate KM-UCL (use when n>=50)	1456	95% Gamma Adjusted KM-UCL (use when n<50)	1475

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.947	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.122	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.126	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	853.5	Mean in Log Scale	5.416
SD in Original Scale	1891	SD in Log Scale	1.649
95% t UCL (assumes normality of ROS data)	1258	95% Percentile Bootstrap UCL	1290
95% BCA Bootstrap UCL	1404	95% Bootstrap t UCL	1470
95% H-UCL (Log ROS)	1559		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.374	KM Geo Mean	215.7
KM SD (logged)	1.74	95% Critical H Value (KM-Log)	2.816
KM Standard Error of Mean (logged)	0.234	95% H-UCL (KM -Log)	1847
KM SD (logged)	1.74	95% Critical H Value (KM-Log)	2.816
KM Standard Error of Mean (logged)	0.234		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	863.4	Mean in Log Scale	5.458
SD in Original Scale	1887	SD in Log Scale	1.697
95% t UCL (Assumes normality)	1267	95% H-Stat UCL	1814

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1847

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	51	Number of Distinct Observations	39
Number of Detects	10	Number of Non-Detects	41
Number of Distinct Detects	10	Number of Distinct Non-Detects	32
Minimum Detect	22	Minimum Non-Detect	21
Maximum Detect	870	Maximum Non-Detect	2200
Variance Detects	71589	Percent Non-Detects	80.39%
Mean Detects	154.5	SD Detects	267.6
Median Detects	45	CV Detects	1.732
Skewness Detects	2.61	Kurtosis Detects	6.922
Mean of Logged Detects	4.209	SD of Logged Detects	1.174

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.556	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.414	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	55.47	KM Standard Error of Mean	20.01
KM SD	128.7	95% KM (BCA) UCL	99.84
95% KM (t) UCL	89.02	95% KM (Percentile Bootstrap) UCL	91.63
95% KM (z) UCL	88.39	95% KM Bootstrap t UCL	231.5
90% KM Chebyshev UCL	115.5	95% KM Chebyshev UCL	142.7
97.5% KM Chebyshev UCL	180.5	99% KM Chebyshev UCL	254.6

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.365	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.759	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.347	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.276	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.724	k star (bias corrected MLE)	0.573
Theta hat (MLE)	213.5	Theta star (bias corrected MLE)	269.6
nu hat (MLE)	14.47	nu star (bias corrected)	11.46
Mean (detects)	154.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	30.41
Maximum	870	Median	0.01
SD	129.3	CV	4.252
k hat (MLE)	0.128	k star (bias corrected MLE)	0.133
Theta hat (MLE)	238.5	Theta star (bias corrected MLE)	228.5
nu hat (MLE)	13.01	nu star (bias corrected)	13.57
Adjusted Level of Significance (β)	0.0453		
Approximate Chi Square Value (13.57, α)	6.281	Adjusted Chi Square Value (13.57, β)	6.136
95% Gamma Approximate UCL (use when n>=50)	65.72	95% Gamma Adjusted UCL (use when n<50)	67.27

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	55.47	SD (KM)	128.7
Variance (KM)	16556	SE of Mean (KM)	20.01
k hat (KM)	0.186	k star (KM)	0.188
nu hat (KM)	18.96	nu star (KM)	19.18
theta hat (KM)	298.4	theta star (KM)	295.1
80% gamma percentile (KM)	70.65	90% gamma percentile (KM)	167.6
95% gamma percentile (KM)	290.4	99% gamma percentile (KM)	631.9

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (19.18, α)	10.25	Adjusted Chi Square Value (19.18, β)	10.06
95% Gamma Approximate KM-UCL (use when n>=50)	103.8	95% Gamma Adjusted KM-UCL (use when n<50)	105.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.809	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.254	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	41.86	Mean in Log Scale	2.874
SD in Original Scale	126.8	SD in Log Scale	0.947
95% t UCL (assumes normality of ROS data)	71.62	95% Percentile Bootstrap UCL	74.99
95% BCA Bootstrap UCL	101.8	95% Bootstrap t UCL	258.6
95% H-UCL (Log ROS)	37.49		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.467	KM Geo Mean	32.04
KM SD (logged)	0.716	95% Critical H Value (KM-Log)	2.039
KM Standard Error of Mean (logged)	0.13	95% H-UCL (KM -Log)	50.91
KM SD (logged)	0.716	95% Critical H Value (KM-Log)	2.039
KM Standard Error of Mean (logged)	0.13		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	146.5	Mean in Log Scale	4.148
SD in Original Scale	230.3	SD in Log Scale	1.249
95% t UCL (Assumes normality)	200.6	95% H-Stat UCL	217.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	50.91

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	61	Number of Distinct Observations	44
Number of Detects	23	Number of Non-Detects	38
Number of Distinct Detects	19	Number of Distinct Non-Detects	26
Minimum Detect	15	Minimum Non-Detect	0.7
Maximum Detect	1600	Maximum Non-Detect	530
Variance Detects	185485	Percent Non-Detects	62.3%
Mean Detects	306.1	SD Detects	430.7
Median Detects	210	CV Detects	1.407
Skewness Detects	2.12	Kurtosis Detects	3.719
Mean of Logged Detects	4.894	SD of Logged Detects	1.361

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.663	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.316	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	129.3	KM Standard Error of Mean	39.4
KM SD	296.8	95% KM (BCA) UCL	196.4
95% KM (t) UCL	195.1	95% KM (Percentile Bootstrap) UCL	198.1
95% KM (z) UCL	194.1	95% KM Bootstrap t UCL	233.6
90% KM Chebyshev UCL	247.5	95% KM Chebyshev UCL	301
97.5% KM Chebyshev UCL	375.3	99% KM Chebyshev UCL	521.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.77	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.785	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.167	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.189	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.724	k star (bias corrected MLE)	0.659
Theta hat (MLE)	422.5	Theta star (bias corrected MLE)	464.5
nu hat (MLE)	33.33	nu star (bias corrected)	30.31
Mean (detects)	306.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	120
Maximum	1600	Median	0.01
SD	300.3	CV	2.503
k hat (MLE)	0.141	k star (bias corrected MLE)	0.145
Theta hat (MLE)	852	Theta star (bias corrected MLE)	828.4
nu hat (MLE)	17.18	nu star (bias corrected)	17.67
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (17.67, α)	9.153	Adjusted Chi Square Value (17.67, β)	9.005
95% Gamma Approximate UCL (use when n>=50)	231.6	95% Gamma Adjusted UCL (use when n<50)	235.5

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	129.3	SD (KM)	296.8
Variance (KM)	88102	SE of Mean (KM)	39.4
k hat (KM)	0.19	k star (KM)	0.191
nu hat (KM)	23.15	nu star (KM)	23.34
theta hat (KM)	681.5	theta star (KM)	675.8
80% gamma percentile (KM)	166.3	90% gamma percentile (KM)	390.8
95% gamma percentile (KM)	673.8	99% gamma percentile (KM)	1459

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (23.34, α)	13.35	Adjusted Chi Square Value (23.34, β)	13.16
95% Gamma Approximate KM-UCL (use when n>=50)	226.1	95% Gamma Adjusted KM-UCL (use when n<50)	229.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.914	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.18	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	124.2	Mean in Log Scale	3.159
SD in Original Scale	297.8	SD in Log Scale	1.748
95% t UCL (assumes normality of ROS data)	187.9	95% Percentile Bootstrap UCL	193.2
95% BCA Bootstrap UCL	208.5	95% Bootstrap t UCL	232.9
95% H-UCL (Log ROS)	205.5		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.206	KM Geo Mean	9.083
KM SD (logged)	2.698	95% Critical H Value (KM-Log)	3.682
KM Standard Error of Mean (logged)	0.405	95% H-UCL (KM -Log)	1246
KM SD (logged)	2.698	95% Critical H Value (KM-Log)	3.682
KM Standard Error of Mean (logged)	0.405		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	163.7	Mean in Log Scale	3.501
SD in Original Scale	292.5	SD in Log Scale	2.312
95% t UCL (Assumes normality)	226.3	95% H-Stat UCL	1316

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	226.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	61	Number of Distinct Observations	53
Number of Detects	40	Number of Non-Detects	21
Number of Distinct Detects	37	Number of Distinct Non-Detects	16
Minimum Detect	8.1	Minimum Non-Detect	1.9
Maximum Detect	5000	Maximum Non-Detect	530
Variance Detects	1271821	Percent Non-Detects	34.43%
Mean Detects	584.1	SD Detects	1128
Median Detects	135	CV Detects	1.931
Skewness Detects	3.011	Kurtosis Detects	8.626
Mean of Logged Detects	5.171	SD of Logged Detects	1.554

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.526	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.94	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.305	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.139	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	397	KM Standard Error of Mean	121.8
KM SD	938.7	95% KM (BCA) UCL	632.6
95% KM (t) UCL	600.6	95% KM (Percentile Bootstrap) UCL	604.3
95% KM (z) UCL	597.4	95% KM Bootstrap t UCL	740.9
90% KM Chebyshev UCL	762.5	95% KM Chebyshev UCL	928
97.5% KM Chebyshev UCL	1158	99% KM Chebyshev UCL	1609

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.943	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.811	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.212	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.147	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.526	k star (bias corrected MLE)	0.503
Theta hat (MLE)	1111	Theta star (bias corrected MLE)	1161
nu hat (MLE)	42.05	nu star (bias corrected)	40.23
Mean (detects)	584.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	384.6
Maximum	5000	Median	73
SD	950.7	CV	2.472
k hat (MLE)	0.186	k star (bias corrected MLE)	0.188
Theta hat (MLE)	2065	Theta star (bias corrected MLE)	2046
nu hat (MLE)	22.72	nu star (bias corrected)	22.93
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (22.93, α)	13.04	Adjusted Chi Square Value (22.93, β)	12.86
95% Gamma Approximate UCL (use when n>=50)	676.4	95% Gamma Adjusted UCL (use when n<50)	685.9

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	397	SD (KM)	938.7
Variance (KM)	881197	SE of Mean (KM)	121.8
k hat (KM)	0.179	k star (KM)	0.181
nu hat (KM)	21.83	nu star (KM)	22.09
theta hat (KM)	2219	theta star (KM)	2193
80% gamma percentile (KM)	494.3	90% gamma percentile (KM)	1198
95% gamma percentile (KM)	2098	99% gamma percentile (KM)	4617

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.09, α)	12.4	Adjusted Chi Square Value (22.09, β)	12.23
95% Gamma Approximate KM-UCL (use when n>=50)	707	95% Gamma Adjusted KM-UCL (use when n<50)	717.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.965	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.94	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.125	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.139	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	393.3	Mean in Log Scale	4.376
SD in Original Scale	947.3	SD in Log Scale	1.786
95% t UCL (assumes normality of ROS data)	596	95% Percentile Bootstrap UCL	615.5
95% BCA Bootstrap UCL	666.4	95% Bootstrap t UCL	754.2
95% H-UCL (Log ROS)	760.3		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.183	KM Geo Mean	65.54
KM SD (logged)	2.118	95% Critical H Value (KM-Log)	3.247
KM Standard Error of Mean (logged)	0.301	95% H-UCL (KM -Log)	1501
KM SD (logged)	2.118	95% Critical H Value (KM-Log)	3.247
KM Standard Error of Mean (logged)	0.301		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	417	Mean in Log Scale	4.584
SD in Original Scale	940.1	SD in Log Scale	1.87
95% t UCL (Assumes normality)	618.1	95% H-Stat UCL	1154

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1501

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	61	Number of Distinct Observations	54
		Number of Missing Observations	0
Minimum	1050	Mean	5281
Maximum	16000	Median	4700
SD	2907	Std. Error of Mean	372.2
Coefficient of Variation	0.55	Skewness	1.101

Normal GOF Test

Shapiro Wilk Test Statistic	0.934	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0.00333	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.0984	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.113	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL

95% Student's-t UCL 5902

95% UCLs (Adjusted for Skewness)

95% Adjusted-CLT UCL (Chen-1995)	5949
95% Modified-t UCL (Johnson-1978)	5911

Gamma GOF Test

A-D Test Statistic	0.193	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.757	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0537	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.115	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.315	k star (bias corrected MLE)	3.163
Theta hat (MLE)	1593	Theta star (bias corrected MLE)	1669
nu hat (MLE)	404.5	nu star (bias corrected)	385.9
MLE Mean (bias corrected)	5281	MLE Sd (bias corrected)	2969
		Approximate Chi Square Value (0.05)	341.4
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	340.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	5969	95% Adjusted Gamma UCL (use when n<50)	5987

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.2	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0915	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.113	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.957	Mean of logged Data	8.413
Maximum of Logged Data	9.68	SD of logged Data	0.597

Assuming Lognormal Distribution

95% H-UCL	6247	90% Chebyshev (MVUE) UCL	6687
95% Chebyshev (MVUE) UCL	7285	97.5% Chebyshev (MVUE) UCL	8114
99% Chebyshev (MVUE) UCL	9744		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5893	95% Jackknife UCL	5902
95% Standard Bootstrap UCL	5876	95% Bootstrap-t UCL	5941
95% Hall's Bootstrap UCL	5961	95% Percentile Bootstrap UCL	5900
95% BCA Bootstrap UCL	5952		
90% Chebyshev(Mean, Sd) UCL	6397	95% Chebyshev(Mean, Sd) UCL	6903
97.5% Chebyshev(Mean, Sd) UCL	7605	99% Chebyshev(Mean, Sd) UCL	8984

Suggested UCL to Use

95% Student's-t UCL	5902

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	61	Number of Distinct Observations	47
Number of Detects	42	Number of Non-Detects	19
Number of Distinct Detects	38	Number of Distinct Non-Detects	12
Minimum Detect	0.18	Minimum Non-Detect	0.17
Maximum Detect	120	Maximum Non-Detect	34.45
Variance Detects	621.1	Percent Non-Detects	31.15%
Mean Detects	11.89	SD Detects	24.92
Median Detects	2.1	CV Detects	2.096
Skewness Detects	3.216	Kurtosis Detects	10.88
Mean of Logged Detects	0.911	SD of Logged Detects	1.78

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.518	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	8.473	KM Standard Error of Mean	2.735
KM SD	21.08	95% KM (BCA) UCL	13.7
95% KM (t) UCL	13.04	95% KM (Percentile Bootstrap) UCL	13.16
95% KM (z) UCL	12.97	95% KM Bootstrap t UCL	16.88
90% KM Chebyshev UCL	16.68	95% KM Chebyshev UCL	20.4
97.5% KM Chebyshev UCL	25.56	99% KM Chebyshev UCL	35.69

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.435	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.832	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.146	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.418	k star (bias corrected MLE)	0.404
Theta hat (MLE)	28.48	Theta star (bias corrected MLE)	29.46
nu hat (MLE)	35.08	nu star (bias corrected)	33.91
Mean (detects)	11.89		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	8.205
Maximum	120	Median	0.68
SD	21.33	CV	2.6
k hat (MLE)	0.25	k star (bias corrected MLE)	0.249
Theta hat (MLE)	32.8	Theta star (bias corrected MLE)	32.98
nu hat (MLE)	30.52	nu star (bias corrected)	30.36
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (30.36, α)	18.77	Adjusted Chi Square Value (30.36, β)	18.55
95% Gamma Approximate UCL (use when n>=50)	13.27	95% Gamma Adjusted UCL (use when n<50)	13.43

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	8.473	SD (KM)	21.08
Variance (KM)	444.5	SE of Mean (KM)	2.735
k hat (KM)	0.162	k star (KM)	0.165
nu hat (KM)	19.71	nu star (KM)	20.07
theta hat (KM)	52.45	theta star (KM)	51.5
80% gamma percentile (KM)	9.901	90% gamma percentile (KM)	25.39
95% gamma percentile (KM)	45.76	99% gamma percentile (KM)	103.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.07, α)	10.9	Adjusted Chi Square Value (20.07, β)	10.74
95% Gamma Approximate KM-UCL (use when n>=50)	15.6	95% Gamma Adjusted KM-UCL (use when n<50)	15.84

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.889	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.942	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.124	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.135	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.394	Mean in Log Scale	0.337
SD in Original Scale	21.26	SD in Log Scale	1.832
95% t UCL (assumes normality of ROS data)	12.94	95% Percentile Bootstrap UCL	13.3
95% BCA Bootstrap UCL	14.82	95% Bootstrap t UCL	17.23
95% H-UCL (Log ROS)	14.97		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.406	KM Geo Mean	1.501
KM SD (logged)	1.729	95% Critical H Value (KM-Log)	2.802
KM Standard Error of Mean (logged)	0.234	95% H-UCL (KM -Log)	12.5
KM SD (logged)	1.729	95% Critical H Value (KM-Log)	2.802
KM Standard Error of Mean (logged)	0.234		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	8.966	Mean in Log Scale	0.66
SD in Original Scale	21.17	SD in Log Scale	1.706
95% t UCL (Assumes normality)	13.49	95% H-Stat UCL	15.29

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	12.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	61	Number of Distinct Observations	48
		Number of Missing Observations	0
Minimum	1.6	Mean	16.92
Maximum	77.2	Median	10.3
SD	16.17	Std. Error of Mean	2.071
Coefficient of Variation	0.956	Skewness	1.998

Normal GOF Test

Shapiro Wilk Test Statistic	0.766	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	9.204E-13	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level	

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	20.38	95% Adjusted-CLT UCL (Chen-1995)	20.89
		95% Modified-t UCL (Johnson-1978)	20.46

Gamma GOF Test

A-D Test Statistic	1.191	**Anderson-Darling Gamma GOF Test**	
5% A-D Critical Value	0.769	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.139	**Kolmogorov-Smirnov Gamma GOF Test**	
5% K-S Critical Value	0.116	Data Not Gamma Distributed at 5% Significance Level	

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.533	k star (bias corrected MLE)	1.469
Theta hat (MLE)	11.03	Theta star (bias corrected MLE)	11.52
nu hat (MLE)	187	nu star (bias corrected)	179.2
MLE Mean (bias corrected)	16.92	MLE Sd (bias corrected)	13.96
		Approximate Chi Square Value (0.05)	149.2
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	148.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	20.31	95% Adjusted Gamma UCL (use when n<50)	20.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.98	**Shapiro Wilk Lognormal GOF Test**	
5% Shapiro Wilk P Value	0.664	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0822	**Lilliefors Lognormal GOF Test**	
5% Lilliefors Critical Value	0.113	Data appear Lognormal at 5% Significance Level	

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.47	Mean of logged Data	2.468
Maximum of Logged Data	4.346	SD of logged Data	0.847

Assuming Lognormal Distribution

95% H-UCL	21.33	90% Chebyshev (MVUE) UCL	22.97
95% Chebyshev (MVUE) UCL	25.79	97.5% Chebyshev (MVUE) UCL	29.69
99% Chebyshev (MVUE) UCL	37.36		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.d')

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	20.32	95% Jackknife UCL	20.38
95% Standard Bootstrap UCL	20.34	95% Bootstrap-t UCL	21.28
95% Hall's Bootstrap UCL	21.27	95% Percentile Bootstrap UCL	20.39
95% BCA Bootstrap UCL	21.03		
90% Chebyshev(Mean, Sd) UCL	23.13	95% Chebyshev(Mean, Sd) UCL	25.94
97.5% Chebyshev(Mean, Sd) UCL	29.85	99% Chebyshev(Mean, Sd) UCL	37.52

Suggested UCL to Use

95% H-UCL 21.33

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	61	Number of Distinct Observations	52
		Number of Missing Observations	0
Minimum	6.3	Mean	277.5
Maximum	2300	Median	170
SD	402.9	Std. Error of Mean	51.59
Coefficient of Variation	1.452	Skewness	3.25

Normal GOF Test

Shapiro Wilk Test Statistic	0.592	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.327	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	363.6	95% Adjusted-CLT UCL (Chen-1995)	385.2
		95% Modified-t UCL (Johnson-1978)	367.2

Gamma GOF Test

A-D Test Statistic	1.891	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.785	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.18	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.118	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.895	k star (bias corrected MLE)	0.862
Theta hat (MLE)	309.9	Theta star (bias corrected MLE)	321.8
nu hat (MLE)	109.2	nu star (bias corrected)	105.2
MLE Mean (bias corrected)	277.5	MLE Sd (bias corrected)	298.8
		Approximate Chi Square Value (0.05)	82.52
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	82.04

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	353.7	95% Adjusted Gamma UCL (use when n<50)	355.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.959	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.093	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.121	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.841	Mean of logged Data	4.972
Maximum of Logged Data	7.741	SD of logged Data	1.19

Assuming Lognormal Distribution

95% H-UCL	416.8	90% Chebyshev (MVUE) UCL	451.3
95% Chebyshev (MVUE) UCL	525.5	97.5% Chebyshev (MVUE) UCL	628.4
99% Chebyshev (MVUE) UCL	830.6		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	362.3	95% Jackknife UCL	363.6
95% Standard Bootstrap UCL	361.3	95% Bootstrap-t UCL	411.2
95% Hall's Bootstrap UCL	403.3	95% Percentile Bootstrap UCL	365
95% BCA Bootstrap UCL	395.4		
90% Chebyshev(Mean, Sd) UCL	432.2	95% Chebyshev(Mean, Sd) UCL	502.3
97.5% Chebyshev(Mean, Sd) UCL	599.6	99% Chebyshev(Mean, Sd) UCL	790.7

Suggested UCL to Use

95% H-UCL	416.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	61	Number of Distinct Observations	51
Number of Detects	55	Number of Non-Detects	6
Number of Distinct Detects	50	Number of Distinct Non-Detects	3
Minimum Detect	0.069	Minimum Non-Detect	0.17
Maximum Detect	54	Maximum Non-Detect	1
Variance Detects	94.06	Percent Non-Detects	9.836%
Mean Detects	5.036	SD Detects	9.699
Median Detects	1.1	CV Detects	1.926
Skewness Detects	3.399	Kurtosis Detects	13.11
Mean of Logged Detects	0.312	SD of Logged Detects	1.669

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.554	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.304	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.119	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.568	KM Standard Error of Mean	1.193
KM SD	9.235	95% KM (BCA) UCL	6.493
95% KM (t) UCL	6.562	95% KM (Percentile Bootstrap) UCL	6.517
95% KM (z) UCL	6.531	95% KM Bootstrap t UCL	7.786
90% KM Chebyshev UCL	8.148	95% KM Chebyshev UCL	9.77
97.5% KM Chebyshev UCL	12.02	99% KM Chebyshev UCL	16.44

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.139	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.818	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.174	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.127	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.489	k star (bias corrected MLE)	0.474
Theta hat (MLE)	10.31	Theta star (bias corrected MLE)	10.63
nu hat (MLE)	53.74	nu star (bias corrected)	52.14
Mean (detects)	5.036		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4.542
Maximum	54	Median	0.89
SD	9.324	CV	2.053
k hat (MLE)	0.392	k star (bias corrected MLE)	0.383
Theta hat (MLE)	11.59	Theta star (bias corrected MLE)	11.85
nu hat (MLE)	47.8	nu star (bias corrected)	46.78
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (46.78, α)	32.08	Adjusted Chi Square Value (46.78, β)	31.79
95% Gamma Approximate UCL (use when n>=50)	6.622	95% Gamma Adjusted UCL (use when n<50)	6.683

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.568	SD (KM)	9.235
Variance (KM)	85.28	SE of Mean (KM)	1.193
k hat (KM)	0.245	k star (KM)	0.244
nu hat (KM)	29.85	nu star (KM)	29.72
theta hat (KM)	18.67	theta star (KM)	18.75
80% gamma percentile (KM)	6.572	90% gamma percentile (KM)	13.74
95% gamma percentile (KM)	22.28	99% gamma percentile (KM)	45.12

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (29.72, α)	18.27	Adjusted Chi Square Value (29.72, β)	18.05
95% Gamma Approximate KM-UCL (use when n>=50)	7.43	95% Gamma Adjusted KM-UCL (use when n<50)	7.52

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.952	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.0524	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.131	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.119	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.571	Mean in Log Scale	0.133
SD in Original Scale	9.31	SD in Log Scale	1.694
95% t UCL (assumes normality of ROS data)	6.562	95% Percentile Bootstrap UCL	6.528
95% BCA Bootstrap UCL	7.358	95% Bootstrap t UCL	7.847
95% H-UCL (Log ROS)	8.772		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.134	KM Geo Mean	1.143
KM SD (logged)	1.673	95% Critical H Value (KM-Log)	2.736
KM Standard Error of Mean (logged)	0.218	95% H-UCL (KM -Log)	8.36
KM SD (logged)	1.673	95% Critical H Value (KM-Log)	2.736
KM Standard Error of Mean (logged)	0.218		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.578	Mean in Log Scale	0.166
SD in Original Scale	9.307	SD in Log Scale	1.66
95% t UCL (Assumes normality)	6.569	95% H-Stat UCL	8.376

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	8.36

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	67	Number of Distinct Observations	48
Number of Detects	54	Number of Non-Detects	13
Number of Distinct Detects	40	Number of Distinct Non-Detects	9
Minimum Detect	0.36	Minimum Non-Detect	0.27
Maximum Detect	54	Maximum Non-Detect	2.8
Variance Detects	88.44	Percent Non-Detects	19.4%
Mean Detects	5.687	SD Detects	9.404
Median Detects	2.65	CV Detects	1.654
Skewness Detects	3.754	Kurtosis Detects	15.68
Mean of Logged Detects	1.087	SD of Logged Detects	1.047

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.531	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.288	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.12	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.692	KM Standard Error of Mean	1.062
KM SD	8.61	95% KM (BCA) UCL	6.662
95% KM (t) UCL	6.463	95% KM (Percentile Bootstrap) UCL	6.496
95% KM (z) UCL	6.438	95% KM Bootstrap t UCL	7.916
90% KM Chebyshev UCL	7.877	95% KM Chebyshev UCL	9.321
97.5% KM Chebyshev UCL	11.32	99% KM Chebyshev UCL	15.26

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.558	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.785	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.19	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.125	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.899	k star (bias corrected MLE)	0.861
Theta hat (MLE)	6.329	Theta star (bias corrected MLE)	6.605
nu hat (MLE)	97.04	nu star (bias corrected)	92.98
Mean (detects)	5.687		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4.585
Maximum	54	Median	2
SD	8.725	CV	1.903
k hat (MLE)	0.425	k star (bias corrected MLE)	0.416
Theta hat (MLE)	10.78	Theta star (bias corrected MLE)	11.01
nu hat (MLE)	57.01	nu star (bias corrected)	55.79
Adjusted Level of Significance (β)	0.0464		
Approximate Chi Square Value (55.79, α)	39.63	Adjusted Chi Square Value (55.79, β)	39.33
95% Gamma Approximate UCL (use when n>=50)	6.456	95% Gamma Adjusted UCL (use when n<50)	6.505

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.692	SD (KM)	8.61
Variance (KM)	74.13	SE of Mean (KM)	1.062
k hat (KM)	0.297	k star (KM)	0.294
nu hat (KM)	39.79	nu star (KM)	39.34
theta hat (KM)	15.8	theta star (KM)	15.98
80% gamma percentile (KM)	7.156	90% gamma percentile (KM)	13.87
95% gamma percentile (KM)	21.61	99% gamma percentile (KM)	41.78

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (39.34, α)	25.97	Adjusted Chi Square Value (39.34, β)	25.73
95% Gamma Approximate KM-UCL (use when n>=50)	7.106	95% Gamma Adjusted KM-UCL (use when n<50)	7.172

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.964	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.196	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.104	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.12	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.685	Mean in Log Scale	0.711
SD in Original Scale	8.676	SD in Log Scale	1.244
95% t UCL (assumes normality of ROS data)	6.453	95% Percentile Bootstrap UCL	6.579
95% BCA Bootstrap UCL	7.173	95% Bootstrap t UCL	8.128
95% H-UCL (Log ROS)	6.13		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.703	KM Geo Mean	2.019
KM SD (logged)	1.256	95% Critical H Value (KM-Log)	2.137
KM Standard Error of Mean (logged)	0.157	95% H-UCL (KM -Log)	6.181
KM SD (logged)	1.256	95% Critical H Value (KM-Log)	2.137
KM Standard Error of Mean (logged)	0.157		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.686	Mean in Log Scale	0.665
SD in Original Scale	8.677	SD in Log Scale	1.346
95% t UCL (Assumes normality)	6.455	95% H-Stat UCL	6.908

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	6.181

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	61	Number of Distinct Observations	47
Number of Detects	60	Number of Non-Detects	1
Number of Distinct Detects	47	Number of Distinct Non-Detects	1
Minimum Detect	1.7	Minimum Non-Detect	10
Maximum Detect	240	Maximum Non-Detect	10
Variance Detects	929.9	Percent Non-Detects	1.639%
Mean Detects	11.76	SD Detects	30.49
Median Detects	6.65	CV Detects	2.593
Skewness Detects	7.352	Kurtosis Detects	55.74
Mean of Logged Detects	1.933	SD of Logged Detects	0.764

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.251	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.371	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.114	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	11.66	KM Standard Error of Mean	3.874
KM SD	30	95% KM (BCA) UCL	19.11
95% KM (t) UCL	18.13	95% KM (Percentile Bootstrap) UCL	19.32
95% KM (z) UCL	18.03	95% KM Bootstrap t UCL	42.89
90% KM Chebyshev UCL	23.28	95% KM Chebyshev UCL	28.55
97.5% KM Chebyshev UCL	35.85	99% KM Chebyshev UCL	50.2

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.413	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.778	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.234	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.118	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.076	k star (bias corrected MLE)	1.034
Theta hat (MLE)	10.93	Theta star (bias corrected MLE)	11.38
nu hat (MLE)	129.1	nu star (bias corrected)	124
Mean (detects)	11.76		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	1.7	Mean	11.61
Maximum	240	Median	6.6
SD	30.26	CV	2.608
k hat (MLE)	1.068	k star (bias corrected MLE)	1.026
Theta hat (MLE)	10.87	Theta star (bias corrected MLE)	11.31
nu hat (MLE)	130.3	nu star (bias corrected)	125.2
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (125.21, α)	100.4	Adjusted Chi Square Value (125.21, β)	99.83
95% Gamma Approximate UCL (use when n>=50)	14.48	95% Gamma Adjusted UCL (use when n<50)	14.56

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	11.66	SD (KM)	30
Variance (KM)	900.1	SE of Mean (KM)	3.874
k hat (KM)	0.151	k star (KM)	0.155
nu hat (KM)	18.43	nu star (KM)	18.85
theta hat (KM)	77.2	theta star (KM)	75.45
80% gamma percentile (KM)	13	90% gamma percentile (KM)	34.71
95% gamma percentile (KM)	63.8	99% gamma percentile (KM)	147.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (18.85, α)	10.01	Adjusted Chi Square Value (18.85, β)	9.854
95% Gamma Approximate KM-UCL (use when n>=50)	21.96	95% Gamma Adjusted KM-UCL (use when n<50)	22.31

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.902	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	5.1655E-5	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.12	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.114	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	11.66	Mean in Log Scale	1.929
SD in Original Scale	30.25	SD in Log Scale	0.758
95% t UCL (assumes normality of ROS data)	18.13	95% Percentile Bootstrap UCL	19.18
95% BCA Bootstrap UCL	23.71	95% Bootstrap t UCL	43.34
95% H-UCL (Log ROS)	11.22		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.928	KM Geo Mean	6.877
KM SD (logged)	0.754	95% Critical H Value (KM-Log)	2.049
KM Standard Error of Mean (logged)	0.0976	95% H-UCL (KM -Log)	11.16
KM SD (logged)	0.754	95% Critical H Value (KM-Log)	2.049
KM Standard Error of Mean (logged)	0.0976		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	11.65	Mean in Log Scale	1.928
SD in Original Scale	30.25	SD in Log Scale	0.759
95% t UCL (Assumes normality)	18.12	95% H-Stat UCL	11.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	28.55

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	61	Number of Distinct Observations	58
		Number of Missing Observations	0
Minimum	7.9	Mean	3706
Maximum	191000	Median	81
SD	24416	Std. Error of Mean	3126
Coefficient of Variation	6.588	Skewness	7.775

Normal GOF Test

Shapiro Wilk Test Statistic	0.153	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.462	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8929	95% Adjusted-CLT UCL (Chen-1995)	12174
		95% Modified-t UCL (Johnson-1978)	9448

Gamma GOF Test

A-D Test Statistic	10	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.902	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.293	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.126	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.224	k star (bias corrected MLE)	0.224
Theta hat (MLE)	16569	Theta star (bias corrected MLE)	16574
nu hat (MLE)	27.29	nu star (bias corrected)	27.28
MLE Mean (bias corrected)	3706	MLE Sd (bias corrected)	7838
		Approximate Chi Square Value (0.05)	16.37
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	16.16

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	6177	95% Adjusted Gamma UCL (use when n<50)	6255

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	1.9126E-4	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.154	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.067	Mean of logged Data	4.985
Maximum of Logged Data	12.16	SD of logged Data	1.899

Assuming Lognormal Distribution

95% H-UCL	1858	90% Chebyshev (MVUE) UCL	1705
95% Chebyshev (MVUE) UCL	2105	97.5% Chebyshev (MVUE) UCL	2660
99% Chebyshev (MVUE) UCL	3749		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	8848	95% Jackknife UCL	8929
95% Standard Bootstrap UCL	8621	95% Bootstrap-t UCL	107229
95% Hall's Bootstrap UCL	54965	95% Percentile Bootstrap UCL	9927
95% BCA Bootstrap UCL	13362		
90% Chebyshev(Mean, Sd) UCL	13085	95% Chebyshev(Mean, Sd) UCL	17333
97.5% Chebyshev(Mean, Sd) UCL	23229	99% Chebyshev(Mean, Sd) UCL	34812

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	17333

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	51	Number of Distinct Observations	35
Number of Detects	18	Number of Non-Detects	33
Number of Distinct Detects	17	Number of Distinct Non-Detects	22
Minimum Detect	0.084	Minimum Non-Detect	0.205
Maximum Detect	14	Maximum Non-Detect	0.79
Variance Detects	10.66	Percent Non-Detects	64.71%
Mean Detects	1.416	SD Detects	3.265
Median Detects	0.345	CV Detects	2.305
Skewness Detects	3.775	Kurtosis Detects	14.92
Mean of Logged Detects	-0.712	SD of Logged Detects	1.252

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.423	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.391	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.639	KM Standard Error of Mean	0.285
KM SD	1.973	95% KM (BCA) UCL	1.118
95% KM (t) UCL	1.116	95% KM (Percentile Bootstrap) UCL	1.181
95% KM (z) UCL	1.107	95% KM Bootstrap t UCL	2.841
90% KM Chebyshev UCL	1.493	95% KM Chebyshev UCL	1.881
97.5% KM Chebyshev UCL	2.418	99% KM Chebyshev UCL	3.474

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.99	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.793	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.324	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.214	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.585	k star (bias corrected MLE)	0.525
Theta hat (MLE)	2.42	Theta star (bias corrected MLE)	2.699
nu hat (MLE)	21.07	nu star (bias corrected)	18.89
Mean (detects)	1.416		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.507
Maximum	14	Median	0.01
SD	2.021	CV	3.986
k hat (MLE)	0.277	k star (bias corrected MLE)	0.274
Theta hat (MLE)	1.831	Theta star (bias corrected MLE)	1.852
nu hat (MLE)	28.25	nu star (bias corrected)	27.92
Adjusted Level of Significance (β)	0.0453		
Approximate Chi Square Value (27.92, α)	16.86	Adjusted Chi Square Value (27.92, β)	16.61
95% Gamma Approximate UCL (use when n>=50)	0.839	95% Gamma Adjusted UCL (use when n<50)	0.852

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.639	SD (KM)	1.973
Variance (KM)	3.891	SE of Mean (KM)	0.285
k hat (KM)	0.105	k star (KM)	0.112
nu hat (KM)	10.69	nu star (KM)	11.4
theta hat (KM)	6.092	theta star (KM)	5.716
80% gamma percentile (KM)	0.515	90% gamma percentile (KM)	1.771
95% gamma percentile (KM)	3.674	99% gamma percentile (KM)	9.591

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.40, α)	4.833	Adjusted Chi Square Value (11.40, β)	4.708
95% Gamma Approximate KM-UCL (use when n>=50)	1.506	95% Gamma Adjusted KM-UCL (use when n<50)	1.546

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.897	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.214	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.626	Mean in Log Scale	-1.364
SD in Original Scale	1.994	SD in Log Scale	0.94
95% t UCL (assumes normality of ROS data)	1.094	95% Percentile Bootstrap UCL	1.145
95% BCA Bootstrap UCL	1.567	95% Bootstrap t UCL	3.004
95% H-UCL (Log ROS)	0.536		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.327	KM Geo Mean	0.265
KM SD (logged)	0.944	95% Critical H Value (KM-Log)	2.25
KM Standard Error of Mean (logged)	0.171	95% H-UCL (KM -Log)	0.559
KM SD (logged)	0.944	95% Critical H Value (KM-Log)	2.25
KM Standard Error of Mean (logged)	0.171		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.667	Mean in Log Scale	-1.153
SD in Original Scale	1.985	SD in Log Scale	0.839
95% t UCL (Assumes normality)	1.133	95% H-Stat UCL	0.579

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1.881

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	61	Number of Distinct Observations	57
		Number of Missing Observations	0
Minimum	1860	Mean	26271
Maximum	210000	Median	15900
SD	33527	Std. Error of Mean	4293
Coefficient of Variation	1.276	Skewness	3.358

Normal GOF Test

Shapiro Wilk Test Statistic	0.647	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	33443	95% Adjusted-CLT UCL (Chen-1995)	35305
		95% Modified-t UCL (Johnson-1978)	33751

Gamma GOF Test

A-D Test Statistic	1.393	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.777	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.151	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.117	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.112	k star (bias corrected MLE)	1.068
Theta hat (MLE)	23621	Theta star (bias corrected MLE)	24588
nu hat (MLE)	135.7	nu star (bias corrected)	130.4
MLE Mean (bias corrected)	26271	MLE Sd (bias corrected)	25416
		Approximate Chi Square Value (0.05)	105
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	104.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	32621	95% Adjusted Gamma UCL (use when n<50)	32793

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.727	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0767	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.113	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.528	Mean of logged Data	9.664
Maximum of Logged Data	12.25	SD of logged Data	1.004

Assuming Lognormal Distribution

95% H-UCL	34888	90% Chebyshev (MVUE) UCL	37499
95% Chebyshev (MVUE) UCL	42829	97.5% Chebyshev (MVUE) UCL	50226
99% Chebyshev (MVUE) UCL	64758		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	33332	95% Jackknife UCL	33443
95% Standard Bootstrap UCL	33358	95% Bootstrap-t UCL	36608
95% Hall's Bootstrap UCL	40396	95% Percentile Bootstrap UCL	33823
95% BCA Bootstrap UCL	35663		
90% Chebyshev(Mean, Sd) UCL	39150	95% Chebyshev(Mean, Sd) UCL	44983
97.5% Chebyshev(Mean, Sd) UCL	53080	99% Chebyshev(Mean, Sd) UCL	68984

Suggested UCL to Use

95% H-UCL 34888

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	61	Number of Distinct Observations	57
		Number of Missing Observations	0
Minimum	3.7	Mean	847.5
Maximum	13000	Median	67.3
SD	2332	Std. Error of Mean	298.6
Coefficient of Variation	2.752	Skewness	4.422

Normal GOF Test

Shapiro Wilk Test Statistic	0.398	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.359	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1346	95% Adjusted-CLT UCL (Chen-1995)	1519
		95% Modified-t UCL (Johnson-1978)	1375

Gamma GOF Test

A-D Test Statistic	4.3	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.854	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.211	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.123	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.338	k star (bias corrected MLE)	0.333
Theta hat (MLE)	2504	Theta star (bias corrected MLE)	2547
nu hat (MLE)	41.3	nu star (bias corrected)	40.6
MLE Mean (bias corrected)	847.5	MLE Sd (bias corrected)	1469
		Approximate Chi Square Value (0.05)	27
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	26.73

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1275	95% Adjusted Gamma UCL (use when n<50)	1287

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.942	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.0103	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.116	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.308	Mean of logged Data	4.745
Maximum of Logged Data	9.473	SD of logged Data	1.96

Assuming Lognormal Distribution

95% H-UCL	1715	90% Chebyshev (MVUE) UCL	1530
95% Chebyshev (MVUE) UCL	1896	97.5% Chebyshev (MVUE) UCL	2404
99% Chebyshev (MVUE) UCL	3402		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	1339	95% Jackknife UCL	1346
95% Standard Bootstrap UCL	1331	95% Bootstrap-t UCL	2148
95% Hall's Bootstrap UCL	3572	95% Percentile Bootstrap UCL	1394
95% BCA Bootstrap UCL	1565		
90% Chebyshev(Mean, Sd) UCL	1743	95% Chebyshev(Mean, Sd) UCL	2149
97.5% Chebyshev(Mean, Sd) UCL	2712	99% Chebyshev(Mean, Sd) UCL	3818

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	2149

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	48	Mean	1389
Maximum	6400	Median	200
SD	2802	Std. Error of Mean	1253
Coefficient of Variation	2.017	Skewness	2.231

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.579	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.459	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4061	95% Adjusted-CLT UCL (Chen-1995)	4787
		95% Modified-t UCL (Johnson-1978)	4269

Gamma GOF Test

A-D Test Statistic	0.772	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.728	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.408	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.377	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.381	k star (bias corrected MLE)	0.286
Theta hat (MLE)	3642	Theta star (bias corrected MLE)	4859
nu hat (MLE)	3.815	nu star (bias corrected)	2.859
MLE Mean (bias corrected)	1389	MLE Sd (bias corrected)	2598
		Approximate Chi Square Value (0.05)	0.332
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.124

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	11967	95% Adjusted Gamma UCL (use when n<50)	32011

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.839	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.304	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.871	Mean of logged Data	5.498
Maximum of Logged Data	8.764	SD of logged Data	1.96

Assuming Lognormal Distribution

95% H-UCL	13842176	90% Chebyshev (MVUE) UCL	2772
95% Chebyshev (MVUE) UCL	3634	97.5% Chebyshev (MVUE) UCL	4830
99% Chebyshev (MVUE) UCL	7179		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - coarse fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3451	95% Jackknife UCL	4061
95% Standard Bootstrap UCL	3213	95% Bootstrap-t UCL	50011
95% Hall's Bootstrap UCL	55519	95% Percentile Bootstrap UCL	3861
95% BCA Bootstrap UCL	3928		
90% Chebyshev(Mean, Sd) UCL	5149	95% Chebyshev(Mean, Sd) UCL	6852
97.5% Chebyshev(Mean, Sd) UCL	9216	99% Chebyshev(Mean, Sd) UCL	13859

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	13859

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	120	Mean	1046
Maximum	4200	Median	290
SD	1765	Std. Error of Mean	789.5
Coefficient of Variation	1.688	Skewness	2.222

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.6	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.451	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2729	95% Adjusted-CLT UCL (Chen-1995)	3183
		95% Modified-t UCL (Johnson-1978)	2860

Gamma GOF Test

A-D Test Statistic	0.832	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.702	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.422	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.368	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.673	k star (bias corrected MLE)	0.402
Theta hat (MLE)	1555	Theta star (bias corrected MLE)	2599
nu hat (MLE)	6.728	nu star (bias corrected)	4.024
MLE Mean (bias corrected)	1046	MLE Sd (bias corrected)	1649
		Approximate Chi Square Value (0.05)	0.731
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.302

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	5756	95% Adjusted Gamma UCL (use when n<50)	13927

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.821	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.348	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.787	Mean of logged Data	6.049
Maximum of Logged Data	8.343	SD of logged Data	1.347

Assuming Lognormal Distribution

95% H-UCL	80161	90% Chebyshev (MVUE) UCL	2174
95% Chebyshev (MVUE) UCL	2789	97.5% Chebyshev (MVUE) UCL	3642
99% Chebyshev (MVUE) UCL	5319		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - fine fraction (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2345	95% Jackknife UCL	2729
95% Standard Bootstrap UCL	2238	95% Bootstrap-t UCL	29525
95% Hall's Bootstrap UCL	24428	95% Percentile Bootstrap UCL	2568
95% BCA Bootstrap UCL	2630		
90% Chebyshev(Mean, Sd) UCL	3414	95% Chebyshev(Mean, Sd) UCL	4487
97.5% Chebyshev(Mean, Sd) UCL	5976	99% Chebyshev(Mean, Sd) UCL	8901

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	4487

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction)

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	0
Minimum	70	Mean	1307
Maximum	5900	Median	220
SD	2569	Std. Error of Mean	1149
Coefficient of Variation	1.966	Skewness	2.23

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.581	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.458	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3756	95% Adjusted-CLT UCL (Chen-1995)	4421
		95% Modified-t UCL (Johnson-1978)	3947

Gamma GOF Test

A-D Test Statistic	0.82	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.418	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.375	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.43	k star (bias corrected MLE)	0.305
Theta hat (MLE)	3038	Theta star (bias corrected MLE)	4279
nu hat (MLE)	4.301	nu star (bias corrected)	3.054
MLE Mean (bias corrected)	1307	MLE Sd (bias corrected)	2365
		Approximate Chi Square Value (0.05)	0.389
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.145

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	10271	95% Adjusted Gamma UCL (use when n<50)	27454

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.815	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.323	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.248	Mean of logged Data	5.663
Maximum of Logged Data	8.683	SD of logged Data	1.783

Assuming Lognormal Distribution

95% H-UCL	2531256	90% Chebyshev (MVUE) UCL	2589
95% Chebyshev (MVUE) UCL	3378	97.5% Chebyshev (MVUE) UCL	4473
99% Chebyshev (MVUE) UCL	6625		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead - total (calculated by fine/coarse fraction) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3197	95% Jackknife UCL	3756
95% Standard Bootstrap UCL	3033	95% Bootstrap-t UCL	43368
95% Hall's Bootstrap UCL	45490	95% Percentile Bootstrap UCL	3571
95% BCA Bootstrap UCL	3636		
90% Chebyshev(Mean, Sd) UCL	4753	95% Chebyshev(Mean, Sd) UCL	6315
97.5% Chebyshev(Mean, Sd) UCL	8482	99% Chebyshev(Mean, Sd) UCL	12738

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	12738

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	61	Number of Distinct Observations	55
		Number of Missing Observations	0
Minimum	6.9	Mean	365.2
Maximum	1945	Median	270
SD	414.9	Std. Error of Mean	53.12
Coefficient of Variation	1.136	Skewness	2.475

Normal GOF Test

Shapiro Wilk Test Statistic	0.706	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	8.882E-16	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.206	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	454	95% Adjusted-CLT UCL (Chen-1995)	470.6
		95% Modified-t UCL (Johnson-1978)	456.8

Gamma GOF Test

A-D Test Statistic	0.512	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.778	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0794	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.117	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.041	k star (bias corrected MLE)	1.001
Theta hat (MLE)	350.8	Theta star (bias corrected MLE)	364.9
nu hat (MLE)	127	nu star (bias corrected)	122.1
MLE Mean (bias corrected)	365.2	MLE Sd (bias corrected)	365.1
		Approximate Chi Square Value (0.05)	97.59
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	97.06

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	457	95% Adjusted Gamma UCL (use when n<50)	459.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.0686	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.105	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.113	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.932	Mean of logged Data	5.349
Maximum of Logged Data	7.573	SD of logged Data	1.169

Assuming Lognormal Distribution

95% H-UCL	589	90% Chebyshev (MVUE) UCL	636.7
95% Chebyshev (MVUE) UCL	739.7	97.5% Chebyshev (MVUE) UCL	882.8
99% Chebyshev (MVUE) UCL	1164		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	452.6	95% Jackknife UCL	454
95% Standard Bootstrap UCL	448.5	95% Bootstrap-t UCL	483.2
95% Hall's Bootstrap UCL	469.7	95% Percentile Bootstrap UCL	456.3
95% BCA Bootstrap UCL	473.5		
90% Chebyshev(Mean, Sd) UCL	524.6	95% Chebyshev(Mean, Sd) UCL	596.8
97.5% Chebyshev(Mean, Sd) UCL	697	99% Chebyshev(Mean, Sd) UCL	893.8

Suggested UCL to Use

95% Approximate Gamma UCL	457

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	61	Number of Distinct Observations	43
Number of Detects	41	Number of Non-Detects	20
Number of Distinct Detects	35	Number of Distinct Non-Detects	11
Minimum Detect	0.023	Minimum Non-Detect	0.008
Maximum Detect	1.2	Maximum Non-Detect	0.17
Variance Detects	0.0417	Percent Non-Detects	32.79%
Mean Detects	0.167	SD Detects	0.204
Median Detects	0.089	CV Detects	1.22
Skewness Detects	3.532	Kurtosis Detects	16.14
Mean of Logged Detects	-2.228	SD of Logged Detects	0.903

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.637	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.941	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.137	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.119	KM Standard Error of Mean	0.0234
KM SD	0.18	95% KM (BCA) UCL	0.17
95% KM (t) UCL	0.158	95% KM (Percentile Bootstrap) UCL	0.162
95% KM (z) UCL	0.158	95% KM Bootstrap t UCL	0.18
90% KM Chebyshev UCL	0.189	95% KM Chebyshev UCL	0.221
97.5% KM Chebyshev UCL	0.265	99% KM Chebyshev UCL	0.352

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.144	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.772	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.144	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.141	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.275	k star (bias corrected MLE)	1.198
Theta hat (MLE)	0.131	Theta star (bias corrected MLE)	0.14
nu hat (MLE)	104.6	nu star (bias corrected)	98.24
Mean (detects)	0.167		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.116
Maximum	1.2	Median	0.053
SD	0.183	CV	1.573
k hat (MLE)	0.718	k star (bias corrected MLE)	0.693
Theta hat (MLE)	0.162	Theta star (bias corrected MLE)	0.167
nu hat (MLE)	87.56	nu star (bias corrected)	84.59
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (84.59, α)	64.39	Adjusted Chi Square Value (84.59, β)	63.97
95% Gamma Approximate UCL (use when n>=50)	0.152	95% Gamma Adjusted UCL (use when n<50)	0.153

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.119	SD (KM)	0.18
Variance (KM)	0.0323	SE of Mean (KM)	0.0234
k hat (KM)	0.439	k star (KM)	0.428
nu hat (KM)	53.57	nu star (KM)	52.27
theta hat (KM)	0.271	theta star (KM)	0.278
80% gamma percentile (KM)	0.194	90% gamma percentile (KM)	0.332
95% gamma percentile (KM)	0.483	99% gamma percentile (KM)	0.861

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (52.27, α)	36.66	Adjusted Chi Square Value (52.27, β)	36.34
95% Gamma Approximate KM-UCL (use when n>=50)	0.17	95% Gamma Adjusted KM-UCL (use when n<50)	0.171

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.941	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.111	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.137	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.12	Mean in Log Scale	-2.793
SD in Original Scale	0.18	SD in Log Scale	1.151
95% t UCL (assumes normality of ROS data)	0.159	95% Percentile Bootstrap UCL	0.164
95% BCA Bootstrap UCL	0.173	95% Bootstrap t UCL	0.178
95% H-UCL (Log ROS)	0.167		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.933	KM Geo Mean	0.0533
KM SD (logged)	1.336	95% Critical H Value (KM-Log)	2.338
KM Standard Error of Mean (logged)	0.18	95% H-UCL (KM -Log)	0.195
KM SD (logged)	1.336	95% Critical H Value (KM-Log)	2.338
KM Standard Error of Mean (logged)	0.18		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.121	Mean in Log Scale	-2.908
SD in Original Scale	0.18	SD in Log Scale	1.415
95% t UCL (Assumes normality)	0.16	95% H-Stat UCL	0.231

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.195

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	61	Number of Distinct Observations	52
		Number of Missing Observations	0
Minimum	4.5	Mean	61.02
Maximum	420	Median	27
SD	90.01	Std. Error of Mean	11.52
Coefficient of Variation	1.475	Skewness	2.842

Normal GOF Test

Shapiro Wilk Test Statistic	0.597	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.265	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	80.28	95% Adjusted-CLT UCL (Chen-1995)	84.46
		95% Modified-t UCL (Johnson-1978)	80.97

Gamma GOF Test

A-D Test Statistic	2.887	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.785	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.165	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.118	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.896	k star (bias corrected MLE)	0.863
Theta hat (MLE)	68.11	Theta star (bias corrected MLE)	70.73
nu hat (MLE)	109.3	nu star (bias corrected)	105.3
MLE Mean (bias corrected)	61.02	MLE Sd (bias corrected)	65.7
		Approximate Chi Square Value (0.05)	82.58
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	82.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	77.78	95% Adjusted Gamma UCL (use when n<50)	78.24

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.00832	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.504	Mean of logged Data	3.458
Maximum of Logged Data	6.04	SD of logged Data	1.074

Assuming Lognormal Distribution

95% H-UCL	77.59	90% Chebyshev (MVUE) UCL	83.48
95% Chebyshev (MVUE) UCL	96.05	97.5% Chebyshev (MVUE) UCL	113.5
99% Chebyshev (MVUE) UCL	147.8		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	79.98	95% Jackknife UCL	80.28
95% Standard Bootstrap UCL	80.22	95% Bootstrap-t UCL	89.6
95% Hall's Bootstrap UCL	84.69	95% Percentile Bootstrap UCL	81.68
95% BCA Bootstrap UCL	86.54		
90% Chebyshev(Mean, Sd) UCL	95.6	95% Chebyshev(Mean, Sd) UCL	111.3
97.5% Chebyshev(Mean, Sd) UCL	133	99% Chebyshev(Mean, Sd) UCL	175.7

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	111.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	61	Number of Distinct Observations	40
Number of Detects	45	Number of Non-Detects	16
Number of Distinct Detects	35	Number of Distinct Non-Detects	9
Minimum Detect	0.098	Minimum Non-Detect	0.039
Maximum Detect	4.5	Maximum Non-Detect	2
Variance Detects	0.779	Percent Non-Detects	26.23%
Mean Detects	0.766	SD Detects	0.882
Median Detects	0.4	CV Detects	1.152
Skewness Detects	2.102	Kurtosis Detects	6.004
Mean of Logged Detects	-0.856	SD of Logged Detects	1.105

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.748	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.945	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.224	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.131	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.648	KM Standard Error of Mean	0.109
KM SD	0.808	95% KM (BCA) UCL	0.823
95% KM (t) UCL	0.83	95% KM (Percentile Bootstrap) UCL	0.836
95% KM (z) UCL	0.827	95% KM Bootstrap t UCL	0.876
90% KM Chebyshev UCL	0.974	95% KM Chebyshev UCL	1.121
97.5% KM Chebyshev UCL	1.326	99% KM Chebyshev UCL	1.728

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.785	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.778	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.171	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.136	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.981	k star (bias corrected MLE)	0.93
Theta hat (MLE)	0.781	Theta star (bias corrected MLE)	0.823
nu hat (MLE)	88.29	nu star (bias corrected)	83.74
Mean (detects)	0.766		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.634
Maximum	4.5	Median	0.24
SD	0.81	CV	1.279
k hat (MLE)	0.696	k star (bias corrected MLE)	0.672
Theta hat (MLE)	0.911	Theta star (bias corrected MLE)	0.942
nu hat (MLE)	84.89	nu star (bias corrected)	82.04
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (82.04, α)	62.17	Adjusted Chi Square Value (82.04, β)	61.75
95% Gamma Approximate UCL (use when n>=50)	0.836	95% Gamma Adjusted UCL (use when n<50)	0.842

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.648	SD (KM)	0.808
Variance (KM)	0.653	SE of Mean (KM)	0.109
k hat (KM)	0.643	k star (KM)	0.623
nu hat (KM)	78.49	nu star (KM)	75.96
theta hat (KM)	1.008	theta star (KM)	1.041
80% gamma percentile (KM)	1.068	90% gamma percentile (KM)	1.672
95% gamma percentile (KM)	2.302	99% gamma percentile (KM)	3.82

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (75.96, α)	56.89	Adjusted Chi Square Value (75.96, β)	56.49
95% Gamma Approximate KM-UCL (use when n>=50)	0.866	95% Gamma Adjusted KM-UCL (use when n<50)	0.872

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.906	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.945	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.131	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.63	Mean in Log Scale	-1.135
SD in Original Scale	0.802	SD in Log Scale	1.187
95% t UCL (assumes normality of ROS data)	0.802	95% Percentile Bootstrap UCL	0.807
95% BCA Bootstrap UCL	0.841	95% Bootstrap t UCL	0.848
95% H-UCL (Log ROS)	0.924		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.131	KM Geo Mean	0.323
KM SD (logged)	1.21	95% Critical H Value (KM-Log)	2.287
KM Standard Error of Mean (logged)	0.17	95% H-UCL (KM -Log)	0.958
KM SD (logged)	1.21	95% Critical H Value (KM-Log)	2.287
KM Standard Error of Mean (logged)	0.17		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.724	Mean in Log Scale	-0.945
SD in Original Scale	0.791	SD in Log Scale	1.242
95% t UCL (Assumes normality)	0.893	95% H-Stat UCL	1.21

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1.121

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	61	Number of Distinct Observations	52
		Number of Missing Observations	0
Minimum	0.91	Mean	24.25
Maximum	92.6	Median	21
SD	17.57	Std. Error of Mean	2.249
Coefficient of Variation	0.724	Skewness	1.545

Normal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	4.0700E-6	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	28.01	95% Adjusted-CLT UCL (Chen-1995)	28.43
		95% Modified-t UCL (Johnson-1978)	28.08

Gamma GOF Test

A-D Test Statistic	0.233	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.764	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.0635	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.115	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.917	k star (bias corrected MLE)	1.833
Theta hat (MLE)	12.65	Theta star (bias corrected MLE)	13.23
nu hat (MLE)	233.8	nu star (bias corrected)	223.7
MLE Mean (bias corrected)	24.25	MLE Sd (bias corrected)	17.91
		Approximate Chi Square Value (0.05)	190
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	189.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	28.54	95% Adjusted Gamma UCL (use when n<50)	28.66

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.0151	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.115	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.0943	Mean of logged Data	2.906
Maximum of Logged Data	4.528	SD of logged Data	0.85

Assuming Lognormal Distribution

95% H-UCL	33.14	90% Chebyshev (MVUE) UCL	35.69
95% Chebyshev (MVUE) UCL	40.08	97.5% Chebyshev (MVUE) UCL	46.16
99% Chebyshev (MVUE) UCL	58.11		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	27.95	95% Jackknife UCL	28.01
95% Standard Bootstrap UCL	27.91	95% Bootstrap-t UCL	28.73
95% Hall's Bootstrap UCL	28.79	95% Percentile Bootstrap UCL	27.87
95% BCA Bootstrap UCL	28.33		
90% Chebyshev(Mean, Sd) UCL	31	95% Chebyshev(Mean, Sd) UCL	34.06
97.5% Chebyshev(Mean, Sd) UCL	38.3	99% Chebyshev(Mean, Sd) UCL	46.63

Suggested UCL to Use

95% Approximate Gamma UCL	28.54

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	61	Number of Distinct Observations	60
		Number of Missing Observations	0
Minimum	7.7	Mean	923.1
Maximum	14000	Median	140
SD	2544	Std. Error of Mean	325.7
Coefficient of Variation	2.756	Skewness	4.117

Normal GOF Test

Shapiro Wilk Test Statistic	0.394	**Shapiro Wilk GOF Test**
5% Shapiro Wilk P Value	0	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.369	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.113	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1467	95% Adjusted-CLT UCL (Chen-1995)	1642
		95% Modified-t UCL (Johnson-1978)	1496

Gamma GOF Test

A-D Test Statistic	4.581	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.846	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.204	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.122	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.374	k star (bias corrected MLE)	0.366
Theta hat (MLE)	2470	Theta star (bias corrected MLE)	2520
nu hat (MLE)	45.6	nu star (bias corrected)	44.69
MLE Mean (bias corrected)	923.1	MLE Sd (bias corrected)	1525
		Approximate Chi Square Value (0.05)	30.36
Adjusted Level of Significance	0.0461	Adjusted Chi Square Value	30.07

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1359	95% Adjusted Gamma UCL (use when n<50)	1372

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk P Value	0.0278	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0982	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.113	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.041	Mean of logged Data	5.048
Maximum of Logged Data	9.547	SD of logged Data	1.771

Assuming Lognormal Distribution

95% H-UCL	1434	90% Chebyshev (MVUE) UCL	1387
95% Chebyshev (MVUE) UCL	1697	97.5% Chebyshev (MVUE) UCL	2127
99% Chebyshev (MVUE) UCL	2973		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1459	95% Jackknife UCL	1467
95% Standard Bootstrap UCL	1464	95% Bootstrap-t UCL	2145
95% Hall's Bootstrap UCL	1567	95% Percentile Bootstrap UCL	1486
95% BCA Bootstrap UCL	1687		
90% Chebyshev(Mean, Sd) UCL	1900	95% Chebyshev(Mean, Sd) UCL	2343
97.5% Chebyshev(Mean, Sd) UCL	2957	99% Chebyshev(Mean, Sd) UCL	4164

Suggested UCL to Use

95% H-UCL	1434

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	51	Number of Distinct Observations	29
Number of Detects	6	Number of Non-Detects	45
Number of Distinct Detects	6	Number of Distinct Non-Detects	24
Minimum Detect	51	Minimum Non-Detect	21
Maximum Detect	1900	Maximum Non-Detect	12000
Variance Detects	462394	Percent Non-Detects	88.24%
Mean Detects	633.5	SD Detects	680
Median Detects	480	CV Detects	1.073
Skewness Detects	1.599	Kurtosis Detects	2.804
Mean of Logged Detects	5.862	SD of Logged Detects	1.317

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.843	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.254	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	95.03	KM Standard Error of Mean	45.41
KM SD	293	95% KM (BCA) UCL	170.6
95% KM (t) UCL	171.1	95% KM (Percentile Bootstrap) UCL	171.6
95% KM (z) UCL	169.7	95% KM Bootstrap t UCL	219.8
90% KM Chebyshev UCL	231.3	95% KM Chebyshev UCL	293
97.5% KM Chebyshev UCL	378.6	99% KM Chebyshev UCL	546.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.184	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.716	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.157	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.341	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.982	k star (bias corrected MLE)	0.602
Theta hat (MLE)	645	Theta star (bias corrected MLE)	1052
nu hat (MLE)	11.79	nu star (bias corrected)	7.226
Mean (detects)	633.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	74.54
Maximum	1900	Median	0.01
SD	297.9	CV	3.996
k hat (MLE)	0.105	k star (bias corrected MLE)	0.112
Theta hat (MLE)	709.8	Theta star (bias corrected MLE)	666
nu hat (MLE)	10.71	nu star (bias corrected)	11.42
Adjusted Level of Significance (β)	0.0453		
Approximate Chi Square Value (11.42, α)	4.844	Adjusted Chi Square Value (11.42, β)	4.72
95% Gamma Approximate UCL (use when n>=50)	175.6	95% Gamma Adjusted UCL (use when n<50)	180.3

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	95.03	SD (KM)	293
Variance (KM)	85851	SE of Mean (KM)	45.41
k hat (KM)	0.105	k star (KM)	0.112
nu hat (KM)	10.73	nu star (KM)	11.43
theta hat (KM)	903.4	theta star (KM)	847.9
80% gamma percentile (KM)	76.85	90% gamma percentile (KM)	263.8
95% gamma percentile (KM)	546.5	99% gamma percentile (KM)	1425

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.43, α)	4.855	Adjusted Chi Square Value (11.43, β)	4.73
95% Gamma Approximate KM-UCL (use when n>=50)	223.8	95% Gamma Adjusted KM-UCL (use when n<50)	229.7

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.167	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	75.99	Mean in Log Scale	0.343
SD in Original Scale	297.5	SD in Log Scale	2.496
95% t UCL (assumes normality of ROS data)	145.8	95% Percentile Bootstrap UCL	153.4
95% BCA Bootstrap UCL	194.3	95% Bootstrap t UCL	279.4
95% H-UCL (Log ROS)	141.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.392	KM Geo Mean	29.74
KM SD (logged)	1.01	95% Critical H Value (KM-Log)	2.316
KM Standard Error of Mean (logged)	0.158	95% H-UCL (KM -Log)	68.93
KM SD (logged)	1.01	95% Critical H Value (KM-Log)	2.316
KM Standard Error of Mean (logged)	0.158		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	217.4	Mean in Log Scale	3.433
SD in Original Scale	876.6	SD in Log Scale	1.442
95% t UCL (Assumes normality)	423.1	95% H-Stat UCL	155.3

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	171.1

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	61	Number of Distinct Observations	36
Number of Detects	7	Number of Non-Detects	54
Number of Distinct Detects	6	Number of Distinct Non-Detects	30
Minimum Detect	360	Minimum Non-Detect	18
Maximum Detect	4200	Maximum Non-Detect	11000
Variance Detects	2055929	Percent Non-Detects	88.52%
Mean Detects	1784	SD Detects	1434
Median Detects	1000	CV Detects	0.804
Skewness Detects	0.778	Kurtosis Detects	-0.68
Mean of Logged Detects	7.161	SD of Logged Detects	0.913

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.876	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	224.2	KM Standard Error of Mean	101.2
KM SD	726	95% KM (BCA) UCL	413.4
95% KM (t) UCL	393.3	95% KM (Percentile Bootstrap) UCL	399.8
95% KM (z) UCL	390.7	95% KM Bootstrap t UCL	452
90% KM Chebyshev UCL	527.9	95% KM Chebyshev UCL	665.5
97.5% KM Chebyshev UCL	856.4	99% KM Chebyshev UCL	1232

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.368	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.719	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.233	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.316	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.683	k star (bias corrected MLE)	1.057
Theta hat (MLE)	1060	Theta star (bias corrected MLE)	1688
nu hat (MLE)	23.56	nu star (bias corrected)	14.8
Mean (detects)	1784		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	204.8
Maximum	4200	Median	0.01
SD	731	CV	3.57
k hat (MLE)	0.0953	k star (bias corrected MLE)	0.102
Theta hat (MLE)	2149	Theta star (bias corrected MLE)	2017
nu hat (MLE)	11.62	nu star (bias corrected)	12.38
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (12.38, α)	5.481	Adjusted Chi Square Value (12.38, β)	5.37
95% Gamma Approximate UCL (use when n>=50)	462.7	95% Gamma Adjusted UCL (use when n<50)	472.2

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	224.2	SD (KM)	726
Variance (KM)	527094	SE of Mean (KM)	101.2
k hat (KM)	0.0953	k star (KM)	0.102
nu hat (KM)	11.63	nu star (KM)	12.39
theta hat (KM)	2351	theta star (KM)	2207
80% gamma percentile (KM)	159.1	90% gamma percentile (KM)	600.5
95% gamma percentile (KM)	1300	99% gamma percentile (KM)	3533

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.39, α)	5.487	Adjusted Chi Square Value (12.39, β)	5.376
95% Gamma Approximate KM-UCL (use when n>=50)	506.3	95% Gamma Adjusted KM-UCL (use when n<50)	516.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.932	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.22	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	222.1	Mean in Log Scale	2.96
SD in Original Scale	726.4	SD in Log Scale	1.874
95% t UCL (assumes normality of ROS data)	377.5	95% Percentile Bootstrap UCL	388.4
95% BCA Bootstrap UCL	459.8	95% Bootstrap t UCL	500.2
95% H-UCL (Log ROS)	229.6		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.39	KM Geo Mean	29.65
KM SD (logged)	1.402	95% Critical H Value (KM-Log)	2.406
KM Standard Error of Mean (logged)	0.196	95% H-UCL (KM -Log)	122.4
KM SD (logged)	1.402	95% Critical H Value (KM-Log)	2.406
KM Standard Error of Mean (logged)	0.196		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	317.5	Mean in Log Scale	3.558
SD in Original Scale	990	SD in Log Scale	1.638
95% t UCL (Assumes normality)	529.3	95% H-Stat UCL	237.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	393.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	51	Number of Distinct Observations	39
Number of Detects	26	Number of Non-Detects	25
Number of Distinct Detects	24	Number of Distinct Non-Detects	17
Minimum Detect	19	Minimum Non-Detect	15
Maximum Detect	450000	Maximum Non-Detect	210
Variance Detects	7.756E+9	Percent Non-Detects	49.02%
Mean Detects	19103	SD Detects	88070
Median Detects	205	CV Detects	4.61
Skewness Detects	5.066	Kurtosis Detects	25.76
Mean of Logged Detects	5.86	SD of Logged Detects	2.308

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.228	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.485	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9749	KM Standard Error of Mean	8910
KM SD	62395	95% KM (BCA) UCL	27235
95% KM (t) UCL	24681	95% KM (Percentile Bootstrap) UCL	26943
95% KM (z) UCL	24405	95% KM Bootstrap t UCL	690540
90% KM Chebyshev UCL	36479	95% KM Chebyshev UCL	48587
97.5% KM Chebyshev UCL	65392	99% KM Chebyshev UCL	98403

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	4.625	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.914	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.342	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.191	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.186	k star (bias corrected MLE)	0.19
Theta hat (MLE)	102613	Theta star (bias corrected MLE)	100369
nu hat (MLE)	9.681	nu star (bias corrected)	9.897
Mean (detects)	19103		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	9739
Maximum	450000	Median	19
SD	63017	CV	6.471
k hat (MLE)	0.0965	k star (bias corrected MLE)	0.104
Theta hat (MLE)	100923	Theta star (bias corrected MLE)	93738
nu hat (MLE)	9.843	nu star (bias corrected)	10.6
Adjusted Level of Significance (β)	0.0453		
Approximate Chi Square Value (10.60, α)	4.318	Adjusted Chi Square Value (10.60, β)	4.202
95% Gamma Approximate UCL (use when n>=50)	23899	95% Gamma Adjusted UCL (use when n<50)	24562

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9749	SD (KM)	62395
Variance (KM)	3.893E+9	SE of Mean (KM)	8910
k hat (KM)	0.0244	k star (KM)	0.036
nu hat (KM)	2.49	nu star (KM)	3.677
theta hat (KM)	399332	theta star (KM)	270437
80% gamma percentile (KM)	320.8	90% gamma percentile (KM)	8671
95% gamma percentile (KM)	43799	99% gamma percentile (KM)	238503

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.68, α)	0.598	Adjusted Chi Square Value (3.68, β)	0.566
95% Gamma Approximate KM-UCL (use when n>=50)	59904	95% Gamma Adjusted KM-UCL (use when n<50)	63377

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.888	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9740	Mean in Log Scale	3.377
SD in Original Scale	63017	SD in Log Scale	3.132
95% t UCL (assumes normality of ROS data)	24529	95% Percentile Bootstrap UCL	27269
95% BCA Bootstrap UCL	45481	95% Bootstrap t UCL	700736
95% H-UCL (Log ROS)	38440		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.424	KM Geo Mean	83.41
KM SD (logged)	2.2	95% Critical H Value (KM-Log)	3.806
KM Standard Error of Mean (logged)	0.318	95% H-UCL (KM -Log)	3066
KM SD (logged)	2.2	95% Critical H Value (KM-Log)	3.806
KM Standard Error of Mean (logged)	0.318		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	9753	Mean in Log Scale	4.487
SD in Original Scale	63015	SD in Log Scale	2.214
95% t UCL (Assumes normality)	24541	95% H-Stat UCL	3412

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	48587

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260)

General Statistics

Total Number of Observations	61	Number of Distinct Observations	37
Number of Detects	16	Number of Non-Detects	45
Number of Distinct Detects	15	Number of Distinct Non-Detects	25
Minimum Detect	23	Minimum Non-Detect	19
Maximum Detect	2800	Maximum Non-Detect	11000
Variance Detects	541558	Percent Non-Detects	73.77%
Mean Detects	497.6	SD Detects	735.9
Median Detects	190	CV Detects	1.479
Skewness Detects	2.426	Kurtosis Detects	6.23
Mean of Logged Detects	5.377	SD of Logged Detects	1.348

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.66	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.293	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	148.2	KM Standard Error of Mean	56.58
KM SD	424.2	95% KM (BCA) UCL	257.7
95% KM (t) UCL	242.7	95% KM (Percentile Bootstrap) UCL	247.5
95% KM (z) UCL	241.3	95% KM Bootstrap t UCL	351.1
90% KM Chebyshev UCL	317.9	95% KM Chebyshev UCL	394.8
97.5% KM Chebyshev UCL	501.5	99% KM Chebyshev UCL	711.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.551	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.777	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.183	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.224	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.723	k star (bias corrected MLE)	0.629
Theta hat (MLE)	688.7	Theta star (bias corrected MLE)	791.4
nu hat (MLE)	23.12	nu star (bias corrected)	20.12
Mean (detects)	497.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	130.5
Maximum	2800	Median	0.01
SD	429.1	CV	3.287
k hat (MLE)	0.116	k star (bias corrected MLE)	0.121
Theta hat (MLE)	1124	Theta star (bias corrected MLE)	1075
nu hat (MLE)	14.17	nu star (bias corrected)	14.81
Adjusted Level of Significance (β)	0.0461		
Approximate Chi Square Value (14.81, α)	7.126	Adjusted Chi Square Value (14.81, β)	6.997
95% Gamma Approximate UCL (use when n>=50)	271.2	95% Gamma Adjusted UCL (use when n<50)	276.2

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1260 (PCB-1260) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	148.2	SD (KM)	424.2
Variance (KM)	179908	SE of Mean (KM)	56.58
k hat (KM)	0.122	k star (KM)	0.127
nu hat (KM)	14.89	nu star (KM)	15.5
theta hat (KM)	1214	theta star (KM)	1167
80% gamma percentile (KM)	138.2	90% gamma percentile (KM)	426
95% gamma percentile (KM)	839.2	99% gamma percentile (KM)	2083

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.50, α)	7.607	Adjusted Chi Square Value (15.50, β)	7.473
95% Gamma Approximate KM-UCL (use when n>=50)	301.9	95% Gamma Adjusted KM-UCL (use when n<50)	307.3

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.981	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0917	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	134	Mean in Log Scale	2.234
SD in Original Scale	428	SD in Log Scale	2.189
95% t UCL (assumes normality of ROS data)	225.6	95% Percentile Bootstrap UCL	234.3
95% BCA Bootstrap UCL	273.3	95% Bootstrap t UCL	320.9
95% H-UCL (Log ROS)	260.6		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.632	KM Geo Mean	37.8
KM SD (logged)	1.267	95% Critical H Value (KM-Log)	2.285
KM Standard Error of Mean (logged)	0.172	95% H-UCL (KM -Log)	122.5
KM SD (logged)	1.267	95% Critical H Value (KM-Log)	2.285
KM Standard Error of Mean (logged)	0.172		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	242.8	Mean in Log Scale	3.74
SD in Original Scale	804.6	SD in Log Scale	1.543
95% t UCL (Assumes normality)	414.9	95% H-Stat UCL	231.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	301.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin

General Statistics

Total Number of Observations	51	Number of Distinct Observations	39
Number of Detects	2	Number of Non-Detects	49
Number of Distinct Detects	2	Number of Distinct Non-Detects	38
Minimum Detect	24	Minimum Non-Detect	0.97
Maximum Detect	560	Maximum Non-Detect	110
Variance Detects	143648	Percent Non-Detects	96.08%
Mean Detects	292	SD Detects	379
Median Detects	292	CV Detects	1.298
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	4.753	SD of Logged Detects	2.227

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	12.5	KM Standard Error of Mean	15.35
KM SD	77.51	95% KM (BCA) UCL	N/A
95% KM (t) UCL	38.23	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	37.75	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	58.56	95% KM Chebyshev UCL	79.42
97.5% KM Chebyshev UCL	108.4	99% KM Chebyshev UCL	165.3

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.66	k star (bias corrected MLE)	N/A
Theta hat (MLE)	442.6	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	2.639	nu star (bias corrected)	N/A
Mean (detects)	292		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	12.5	SD (KM)	77.51
Variance (KM)	6008	SE of Mean (KM)	15.35
k hat (KM)	0.026	k star (KM)	0.0375
nu hat (KM)	2.651	nu star (KM)	3.828
theta hat (KM)	480.8	theta star (KM)	332.9
80% gamma percentile (KM)	0.505	90% gamma percentile (KM)	12.04
95% gamma percentile (KM)	57.67	99% gamma percentile (KM)	301.7

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0453
Approximate Chi Square Value (3.83, α)	0.655	Adjusted Chi Square Value (3.83, β)	0.62
95% Gamma Approximate KM-UCL (use when n>=50)	73.03	95% Gamma Adjusted KM-UCL (use when n<50)	77.15

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	11.45	Mean in Log Scale	-8.786
SD in Original Scale	78.42	SD in Log Scale	3.424
95% t UCL (assumes normality of ROS data)	29.85	95% Percentile Bootstrap UCL	33.41
95% BCA Bootstrap UCL	44.86	95% Bootstrap t UCL	326609
95% H-UCL (Log ROS)	0.796		

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dieldrin (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.173	KM Geo Mean	1.189
KM SD (logged)	1.002	95% Critical H Value (KM-Log)	2.308
KM Standard Error of Mean (logged)	0.204	95% H-UCL (KM -Log)	2.723
KM SD (logged)	1.002	95% Critical H Value (KM-Log)	2.308
KM Standard Error of Mean (logged)	0.204		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	21.72	Mean in Log Scale	1.622
SD in Original Scale	78.32	SD in Log Scale	1.523
95% t UCL (Assumes normality)	40.1	95% H-Stat UCL	30.25

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	79.42

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysotile asbestos

General Statistics

Total Number of Observations	15	Number of Distinct Observations	3
Number of Detects	3	Number of Non-Detects	12
Number of Distinct Detects	2	Number of Distinct Non-Detects	2
Minimum Detect	0.25	Minimum Non-Detect	0.25
Maximum Detect	0.5	Maximum Non-Detect	1
Variance Detects	0.0208	Percent Non-Detects	80%
Mean Detects	0.333	SD Detects	0.144
Median Detects	0.25	CV Detects	0.433
Skewness Detects	1.732	Kurtosis Detects	N/A
Mean of Logged Detects	-1.155	SD of Logged Detects	0.4

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.273	KM Standard Error of Mean	0.0265
KM SD	0.0719	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.319	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.316	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.352	95% KM Chebyshev UCL	0.388
97.5% KM Chebyshev UCL	0.438	99% KM Chebyshev UCL	0.537

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	8.992	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0371	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	53.95	nu star (bias corrected)	N/A
Mean (detects)	0.333		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0912
Maximum	0.5	Median	0.01
SD	0.147	CV	1.607
k hat (MLE)	0.523	k star (bias corrected MLE)	0.463
Theta hat (MLE)	0.174	Theta star (bias corrected MLE)	0.197
nu hat (MLE)	15.7	nu star (bias corrected)	13.89
Adjusted Level of Significance (β)	0.0324		
Approximate Chi Square Value (13.89, α)	6.496	Adjusted Chi Square Value (13.89, β)	5.884
95% Gamma Approximate UCL (use when n>=50)	0.195	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.16.4

Summary of ProUCL Output for EU18-EU19 Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.15/9/2019 12:16:33 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysotile asbestos (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.273	SD (KM)	0.0719
Variance (KM)	0.00517	SE of Mean (KM)	0.0265
k hat (KM)	14.4	k star (KM)	11.56
nu hat (KM)	432	nu star (KM)	346.9
theta hat (KM)	0.0189	theta star (KM)	0.0236
80% gamma percentile (KM)	0.337	90% gamma percentile (KM)	0.379
95% gamma percentile (KM)	0.417	99% gamma percentile (KM)	0.493

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (346.93, α)	304.8	Adjusted Chi Square Value (346.93, β)	299.9
95% Gamma Approximate KM-UCL (use when n>=50)	0.31	95% Gamma Adjusted KM-UCL (use when n<50)	0.315

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.75	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.385	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.133	Mean in Log Scale	-2.392
SD in Original Scale	0.128	SD in Log Scale	0.905
95% t UCL (assumes normality of ROS data)	0.192	95% Percentile Bootstrap UCL	0.186
95% BCA Bootstrap UCL	0.2	95% Bootstrap t UCL	0.225
95% H-UCL (Log ROS)	0.258		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.323	KM Geo Mean	0.266
KM SD (logged)	0.199	95% Critical H Value (KM-Log)	1.809
KM Standard Error of Mean (logged)	0.0736	95% H-UCL (KM -Log)	0.299
KM SD (logged)	0.199	95% Critical H Value (KM-Log)	1.809
KM Standard Error of Mean (logged)	0.0736		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.267	Mean in Log Scale	-1.525
SD in Original Scale	0.176	SD in Log Scale	0.652
95% t UCL (Assumes normality)	0.347	95% H-Stat UCL	0.398

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.319

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.17.1

Summary of ProUCL Input Data for All EUs TCDD Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3
EU:	**Sample Depth:**	**Sample Location:**	**Sample Date:**	Total TEQ (DL @ 0)	D_Total TEQ (DL @ 0)	Total TEQ (DL @ 0.5)	D_Total TEQ (DL @ 0.5)
on-site (EU16)	1-3 ft BGS	BH136-18	1/8/2018	41.9912	1	47.37595	1
on-site (EU18)	0-2 ft BGS	SS-26	10/26/2018	18.859	1	19.21035	1
on-site (EU18)	0-2 ft BGS	SS-27	10/26/2018	0.0889	1	0.463355	1
on-site (EU18)	0-2 ft BGS	SS-28	10/26/2018	2.1633	1	2.5108	1
on-site (EU18)	0.17-2.17 ft BGS	SS-33	10/26/2018	3.491	1	3.85885	1
on-site (EU18)	0-2 ft BGS	SS-34	10/26/2018	0.527	1	2.05795	1
on-site (EU19)	0-2 ft BGS	SS-35	10/30/2017	2.3946	1	2.40525	1

Table B.17.2

Summary of ProUCL Output for All EUs TCDD Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	10/15/2019 1:21:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.0889	Mean	9.931
Maximum	41.99	Median	2.395
SD	15.55	Std. Error of Mean	5.879
Coefficient of Variation	1.566	Skewness	1.905

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.0

Normal GOF Test

Shapiro Wilk Test Statistic	0.699	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.375	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.335	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	21.35	95% Adjusted-CLT UCL (Chen-1995)	24.12
		95% Modified-t UCL (Johnson-1978)	22.06

Gamma GOF Test

A-D Test Statistic	0.321	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.254	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.328	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.47	k star (bias corrected MLE)	0.364
Theta hat (MLE)	21.15	Theta star (bias corrected MLE)	27.31
nu hat (MLE)	6.575	nu star (bias corrected)	5.09
MLE Mean (bias corrected)	9.931	MLE Sd (bias corrected)	16.47
		Approximate Chi Square Value (0.05)	1.194
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	0.721

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	42.33	95% Adjusted Gamma UCL (use when n<50)	70.13

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.335	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.42	Mean of logged Data	0.93
Maximum of Logged Data	3.737	SD of logged Data	2.071

Assuming Lognormal Distribution

95% H-UCL	7847	90% Chebyshev (MVUE) UCL	37.37
95% Chebyshev (MVUE) UCL	48.91	97.5% Chebyshev (MVUE) UCL	64.93
99% Chebyshev (MVUE) UCL	96.38		

Table B.17.2

Summary of ProUCL Output for All EUs TCDD Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	10/15/2019 1:21:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	19.6	95% Jackknife UCL	21.35
95% Standard Bootstrap UCL	18.91	95% Bootstrap-t UCL	114
95% Hall's Bootstrap UCL	105.8	95% Percentile Bootstrap UCL	19.22
95% BCA Bootstrap UCL	23.74		
90% Chebyshev(Mean, Sd) UCL	27.57	95% Chebyshev(Mean, Sd) UCL	35.56
97.5% Chebyshev(Mean, Sd) UCL	46.64	99% Chebyshev(Mean, Sd) UCL	68.42

Suggested UCL to Use

95% Adjusted Gamma UCL	70.13

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Table B.17.2

Summary of ProUCL Output for All EUs TCDD Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	10/15/2019 1:21:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0.5)

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	0
Minimum	0.463	Mean	11.13
Maximum	47.38	Median	2.511
SD	17.22	Std. Error of Mean	6.507
Coefficient of Variation	1.547	Skewness	2.036

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.0

Normal GOF Test

Shapiro Wilk Test Statistic	0.675	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.378	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.335	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	23.77	95% Adjusted-CLT UCL (Chen-1995)	27.18
		95% Modified-t UCL (Johnson-1978)	24.61

Gamma GOF Test

A-D Test Statistic	0.597	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.744	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.317	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.325	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.619	k star (bias corrected MLE)	0.449
Theta hat (MLE)	17.96	Theta star (bias corrected MLE)	24.77
nu hat (MLE)	8.671	nu star (bias corrected)	6.288
MLE Mean (bias corrected)	11.13	MLE Sd (bias corrected)	16.6
		Approximate Chi Square Value (0.05)	1.789
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	1.159

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	39.11	95% Adjusted Gamma UCL (use when n<50)	60.39

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.335	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.769	Mean of logged Data	1.416
Maximum of Logged Data	3.858	SD of logged Data	1.535

Assuming Lognormal Distribution

95% H-UCL	368.2	90% Chebyshev (MVUE) UCL	27.53
95% Chebyshev (MVUE) UCL	35.36	97.5% Chebyshev (MVUE) UCL	46.25
99% Chebyshev (MVUE) UCL	67.62		

Table B.17.2

Summary of ProUCL Output for All EUs TCDD Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	10/15/2019 1:21:52 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0.5) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	21.83	95% Jackknife UCL	23.77
95% Standard Bootstrap UCL	21.04	95% Bootstrap-t UCL	162.7
95% Hall's Bootstrap UCL	118.3	95% Percentile Bootstrap UCL	21.69
95% BCA Bootstrap UCL	26.45		
90% Chebyshev(Mean, Sd) UCL	30.65	95% Chebyshev(Mean, Sd) UCL	39.49
97.5% Chebyshev(Mean, Sd) UCL	51.76	99% Chebyshev(Mean, Sd) UCL	75.87

Suggested UCL to Use

95% Adjusted Gamma UCL	60.39

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Table B.17.3

Summary of ProUCL Input Data for All EUs TCDD Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3
EU:	**Sample Depth:**	**Sample Location:**	**Sample Date:**	Total TEQ (DL @ 0)	D_Total TEQ (DL @ 0)	Total TEQ (DL @ 0.5)	D_Total TEQ (DL @ 0.5)
on-site (EU09)	8-10 ft BGS	TP-17	11/2/2017	0.6497	1	0.65636	1
on-site (EU10)	13-15 ft BGS	BH97-17	12/8/2017	1.1556	1	1.23445	1
on-site (EU11)	8-10 ft BGS	TP-13	11/1/2017	2.4501	1	2.458783	1
on-site (EU12)	13-15 ft BGS	BH112-17	12/19/2017	0.2569	1	0.40989	1
on-site (EU13)	6-8 ft BGS	TT-40	11/3/2017	3.6064	1	3.60875	1
on-site (EU14)	8.5-10.5 ft BGS	BH105-18	1/17/2018	10.5855	1	11.0655	1
on-site (EU15)	10-12 ft BGS	BH143-18	1/23/2018	0.105225	1	0.59470175	1
on-site (EU15)	14.5-16.5 ft BGS	BH144-18	1/22/2018	0.06686	1	0.65391	1
on-site (EU15)	9-11 ft BGS	BH145-18	1/22/2018	2.91795	1	3.117	1
on-site (EU15)	6-8 ft BGS	TT-43	11/8/2017	74.539	1	74.729	1
on-site (EU16)	1-3 ft BGS	BH136-18	1/8/2018	41.9912	1	47.37595	1
on-site (EU16)	15-17 ft BGS	BH136-18	1/8/2018	16.4791	1	17.0391	1
on-site (EU16)	13-15 ft BGS	BH137-18	1/8/2018	472.24022	1	472.31522	1
on-site (EU16)	26-28 ft BGS	BH137-18	1/8/2018	206.961	1	207.336	1
on-site (EU16)	8-10 ft BGS	BH138-18	1/9/2018	4.2693	1	4.3828	1
on-site (EU16)	13-15 ft BGS	BH139-18	1/4/2018	12.0275	1	12.1925	1
on-site (EU16)	13-15 ft BGS	BH140-18	1/8/2018	74.86714	1	74.97214	1
on-site (EU16)	6-8 ft BGS	BH141-18	1/9/2018	30.067	1	30.142	1
on-site (EU16)	8-10 ft BGS	BH142-18	1/4/2018	826.164	1	826.564	1
on-site (EU16)	13-15 ft BGS	TT-24	3/20/2018	183.269	1	183.319	1
on-site (EU16)	2-4 ft bgs	TT-24	3/20/2018	8.3636	1	8.3806	1
on-site (EU17)	14-15 ft BGS	TP-8	11/9/2017	0.31273	1	0.33714815	1
on-site (EU17)	2-4 ft BGS	TP-9	11/9/2017	1.6366	1	2.24260285	1
on-site (EU17)	4-6 ft BGS	TP-10	11/9/2017	86.2088	1	86.2578	1
on-site (EU18)	0-2 ft BGS	SS-26	10/26/2018	18.859	1	19.21035	1
on-site (EU18)	0-2 ft BGS	SS-27	10/26/2018	0.0889	1	0.463355	1
on-site (EU18)	0-2 ft BGS	SS-28	10/26/2018	2.1633	1	2.5108	1
on-site (EU18)	0.17-2.17 ft BGS	SS-33	10/26/2018	3.491	1	3.85885	1
on-site (EU18)	0-2 ft BGS	SS-34	10/26/2018	0.527	1	2.05795	1
on-site (EU19)	13-14.8 ft BGS	BH94-17	12/20/2017	2.727	1	3.4857	1
on-site (EU19)	5-7 ft BGS	BH95-17	12/19/2017	1.9179	1	2.5926	1
on-site (EU19)	13-15 ft BGS	BH96-18	1/3/2018	1.74117	1	1.75417	1
on-site (EU19)	0-2 ft BGS	SS-35	10/30/2017	2.3946	1	2.40525	1
on-site (EU19)	8-10 ft BGS	TP-11	10/31/2017	22.725	1	22.8215	1
on-site (EU19)	8-10 ft BGS	TP-12	11/1/2017	9.8394	1	9.95633	1
on-site (EU19)	8-10 ft BGS	TP-14	10/31/2017	3.4178	1	3.42250615	1
on-site (EU19)	4-6 ft BGS	TP-16	10/31/2017	2.7583	1	2.76171	1
on-site (EU19)	14-15 ft BGS	TT-31	11/7/2017	512.05	1	512.275	1
on-site (EU19)	12-14 ft BGS	TT-32	11/7/2017	22.755	1	25.6955	1
on-site (EU19)	12-14 ft BGS	TT-33	11/3/2017	7.4448	1	7.4487	1
on-site (EU19)	8-10 ft BGS	TT-34	11/7/2017	307.244	1	309.544	1
on-site (EU19)	12-14 ft BGS	TT-35	11/6/2017	146.09	1	146.15	1
on-site (EU19)	2-4 ft BGS	TT-36	11/6/2017	67.37	1	68.5873175	1
on-site (EU19)	8-10 ft BGS	TT-37	11/6/2017	1.3702	1	1.58785	1
on-site (EU19)	8-10 ft BGS	TT-39	11/2/2017	3.4965	1	3.496524	1

Table B.17.4

Summary of ProUCL Output for All EUs TCDD Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	10/15/2019 12:19:32 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0)

General Statistics

Total Number of Observations	45	Number of Distinct Observations	45
		Number of Missing Observations	0
Minimum	0.0669	Mean	71.15
Maximum	826.2	Median	4.269
SD	162.4	Std. Error of Mean	24.21
Coefficient of Variation	2.282	Skewness	3.27

Normal GOF Test

Shapiro Wilk Test Statistic	0.507	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.945	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.333	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.132	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	111.8	95% Adjusted-CLT UCL (Chen-1995)	123.6
		95% Modified-t UCL (Johnson-1978)	113.8

Gamma GOF Test

A-D Test Statistic	2.094	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.86	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.143	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.307	k star (bias corrected MLE)	0.302
Theta hat (MLE)	231.5	Theta star (bias corrected MLE)	235.9
nu hat (MLE)	27.66	nu star (bias corrected)	27.15
MLE Mean (bias corrected)	71.15	MLE Sd (bias corrected)	129.5
		Approximate Chi Square Value (0.05)	16.27
Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	15.99

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	118.7	95% Adjusted Gamma UCL (use when n<50)	120.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.945	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.112	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.132	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.705	Mean of logged Data	2.03
Maximum of Logged Data	6.717	SD of logged Data	2.377

Assuming Lognormal Distribution

95% H-UCL	586.2	90% Chebyshev (MVUE) UCL	270.6
95% Chebyshev (MVUE) UCL	346	97.5% Chebyshev (MVUE) UCL	450.6
99% Chebyshev (MVUE) UCL	656		

Table B.17.4

Summary of ProUCL Output for All EUs TCDD Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	10/15/2019 12:19:32 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	111	95% Jackknife UCL	111.8
95% Standard Bootstrap UCL	110.9	95% Bootstrap-t UCL	139.4
95% Hall's Bootstrap UCL	124.9	95% Percentile Bootstrap UCL	112.5
95% BCA Bootstrap UCL	125.2		
90% Chebyshev(Mean, Sd) UCL	143.8	95% Chebyshev(Mean, Sd) UCL	176.7
97.5% Chebyshev(Mean, Sd) UCL	222.3	99% Chebyshev(Mean, Sd) UCL	312

Suggested UCL to Use

97.5% Chebyshev (Mean, Sd) UCL	222.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Table B.17.4

Summary of ProUCL Output for All EUs TCDD Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	10/15/2019 12:19:32 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0.5)

General Statistics

Total Number of Observations	45	Number of Distinct Observations	45
		Number of Missing Observations	0
Minimum	0.337	Mean	71.63
Maximum	826.6	Median	4.383
SD	162.4	Std. Error of Mean	24.21
Coefficient of Variation	2.267	Skewness	3.267

Normal GOF Test

Shapiro Wilk Test Statistic	0.508	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.945	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.334	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.132	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	112.3	95% Adjusted-CLT UCL (Chen-1995)	124.1
		95% Modified-t UCL (Johnson-1978)	114.3

Gamma GOF Test

A-D Test Statistic	2.78	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.854	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.207	**Kolmogrov-Smirnoff Gamma GOF Test**
5% K-S Critical Value	0.143	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.333	k star (bias corrected MLE)	0.326
Theta hat (MLE)	214.8	Theta star (bias corrected MLE)	219.7
nu hat (MLE)	30.01	nu star (bias corrected)	29.34
MLE Mean (bias corrected)	71.63	MLE Sd (bias corrected)	125.5
		Approximate Chi Square Value (0.05)	17.98
Adjusted Level of Significance	0.0447	Adjusted Chi Square Value	17.68

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	116.9	95% Adjusted Gamma UCL (use when n<50)	118.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.94	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.945	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.152	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.132	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.087	Mean of logged Data	2.239
Maximum of Logged Data	6.717	SD of logged Data	2.105

Assuming Lognormal Distribution

95% H-UCL	291.2	90% Chebyshev (MVUE) UCL	177.5
95% Chebyshev (MVUE) UCL	224.1	97.5% Chebyshev (MVUE) UCL	288.7
99% Chebyshev (MVUE) UCL	415.6		

Table B.17.4

Summary of ProUCL Output for All EUs TCDD Soil (0-15 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	10/15/2019 12:19:32 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Total TEQ (DL @ 0.5) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	111.5	95% Jackknife UCL	112.3
95% Standard Bootstrap UCL	110.5	95% Bootstrap-t UCL	144.6
95% Hall's Bootstrap UCL	126.6	95% Percentile Bootstrap UCL	115.4
95% BCA Bootstrap UCL	125.3		
90% Chebyshev(Mean, Sd) UCL	144.3	95% Chebyshev(Mean, Sd) UCL	177.2
97.5% Chebyshev(Mean, Sd) UCL	222.8	99% Chebyshev(Mean, Sd) UCL	312.5

Suggested UCL to Use

97.5% Chebyshev (Mean, Sd) UCL	222.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
These recommendations are based upon the results of the simulation studies summarized in Singh, Singh, and Iaci (2002)
and Singh and Singh (2003). However, simulations results will not cover all Real World data sets.
For additional insight the user may want to consult a statistician.

Table B.18.1

Summary of ProUCL Input Data for EU09-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

		0	1	2	3	4	5	6	7	8	9	10	11
Sample Location:	**Sample ID:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Carbon tetrachloride	D_Carbon tetrachloride	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	Tetrachloroethene	D_Tetrachloroethene	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride
GP12-09	8/20/2018	1.1	0	2.4	0	1.9	0	92	1	690	1	1.8	0
GP13-09	8/20/2018	310	1	0.24	0	3.6	1	1.3	1	1.3	1	3.1	1
GP14-09	8/20/2018	1.7	1	0.96	0	7.6	1	370	1	520	1	0.73	0
GP15-09	8/20/2018	3200	1	9.2	1	17	1	25	1	3400	1	14	1
GP16-09	8/23/2018	55	1	25	0	19	0	28	0	20	0	370	1
GP20-18	8/23/2018	14	0	32	0	25	0	37	0	6700	1	25	0
GP22-13	8/23/2018	1.7	1	0.24	0	0.37	1	1.9	1	2.7	1	42	1
GP23-13	8/22/2018	0.42	0	0.96	0	1.8	1	1.1	0	600	1	0.73	0
GP24A-13	8/22/2018	0.11	0	36	1	0.29	1	0.27	0	0.75	1	0.3	1
GP24B-13	8/22/2018	0.11	0	0.34	1	0.19	0	1.9	1	0.19	0	0.18	0
GP30-18	8/22/2018	0.11	0	0.27	1	0.19	0	0.27	0	2.1	1	0.18	0
GP31-18	8/22/2018	28	0	64	0	110	1	73	0	27000	1	49	0
GP32-18	8/24/2018	1.5	1	2.4	0	8	1	2.7	0	590	1	1.8	0
GP33-18	8/23/2018	0.11	0	0.39	1	0.96	1	2.2	1	15	1	0.18	0
GP20-09	9/14/2009	420	0	660	0	510	0	710	0	56000	1	540	0
GP20-09	1/29/2010	160	0	250	0	200	0	270	0	16000	1	210	0
GP3-8	7/30/2012	3.1	0	4.9	0	3.8	0	22	1	670	1	2	0
GP4-16	7/30/2012	3.1	0	4.8	0	5.8	1	7.1	1	260	1	1.9	0
GP6-12	7/30/2012	3	0	4.7	0	3.6	0	69	1	220	1	1.9	0

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	19	Number of Distinct Observations	14
Number of Detects	6	Number of Non-Detects	13
Number of Distinct Detects	5	Number of Distinct Non-Detects	9
Minimum Detect	1.5	Minimum Non-Detect	0.11
Maximum Detect	3200	Maximum Non-Detect	420
Variance Detects	1643020	Percent Non-Detects	68.42%
Mean Detects	595	SD Detects	1282
Median Detects	28.35	CV Detects	2.154
Skewness Detects	2.403	Kurtosis Detects	5.812
Mean of Logged Detects	3.214	SD of Logged Detects	3.252

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.562	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.421	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	189.5	KM Standard Error of Mean	179.3
KM SD	713.1	95% KM (BCA) UCL	525.8
95% KM (t) UCL	500.4	95% KM (Percentile Bootstrap) UCL	512.8
95% KM (z) UCL	484.4	95% KM Bootstrap t UCL	8378
90% KM Chebyshev UCL	727.3	95% KM Chebyshev UCL	970.9
97.5% KM Chebyshev UCL	1309	99% KM Chebyshev UCL	1973

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.588	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.792	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.293	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.362	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.227	k star (bias corrected MLE)	0.225
Theta hat (MLE)	2619	Theta star (bias corrected MLE)	2648
nu hat (MLE)	2.726	nu star (bias corrected)	2.696
Mean (detects)	595		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	187.9
Maximum	3200	Median	0.01
SD	732.9	CV	3.901
k hat (MLE)	0.109	k star (bias corrected MLE)	0.127
Theta hat (MLE)	1724	Theta star (bias corrected MLE)	1481
nu hat (MLE)	4.14	nu star (bias corrected)	4.82
Adjusted Level of Significance (β)	0.0369		
Approximate Chi Square Value (4.82, α)	1.07	Adjusted Chi Square Value (4.82, β)	0.927
95% Gamma Approximate UCL (use when n>=50)	846.5	95% Gamma Adjusted UCL (use when n<50)	977.4

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	189.5	SD (KM)	713.1
Variance (KM)	508581	SE of Mean (KM)	179.3
k hat (KM)	0.0706	k star (KM)	0.0945
nu hat (KM)	2.683	nu star (KM)	3.592
theta hat (KM)	2684	theta star (KM)	2004
80% gamma percentile (KM)	120.8	90% gamma percentile (KM)	492
95% gamma percentile (KM)	1103	99% gamma percentile (KM)	3095

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.59, α)	0.568	Adjusted Chi Square Value (3.59, β)	0.477
95% Gamma Approximate KM-UCL (use when n>=50)	1199	95% Gamma Adjusted KM-UCL (use when n<50)	1427

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.848	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.295	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	187.9	Mean in Log Scale	-1.74
SD in Original Scale	732.9	SD in Log Scale	4.156
95% t UCL (assumes normality of ROS data)	479.5	95% Percentile Bootstrap UCL	511.3
95% BCA Bootstrap UCL	696.1	95% Bootstrap t UCL	10976
95% H-UCL (Log ROS)	2534970		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.106	KM Geo Mean	0.899
KM SD (logged)	2.996	95% Critical H Value (KM-Log)	6.07
KM Standard Error of Mean (logged)	0.808	95% H-UCL (KM -Log)	5816
KM SD (logged)	2.996	95% Critical H Value (KM-Log)	6.07
KM Standard Error of Mean (logged)	0.808		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	204.6	Mean in Log Scale	1.111
SD in Original Scale	730.1	SD in Log Scale	3.222
95% t UCL (Assumes normality)	495	95% H-Stat UCL	75729

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	1427

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbon tetrachloride

General Statistics

Total Number of Observations	19	Number of Distinct Observations	16
Number of Detects	5	Number of Non-Detects	14
Number of Distinct Detects	5	Number of Distinct Non-Detects	11
Minimum Detect	0.27	Minimum Non-Detect	0.24
Maximum Detect	36	Maximum Non-Detect	660
Variance Detects	238.5	Percent Non-Detects	73.68%
Mean Detects	9.24	SD Detects	15.44
Median Detects	0.39	CV Detects	1.671
Skewness Detects	1.928	Kurtosis Detects	3.681
Mean of Logged Detects	0.495	SD of Logged Detects	2.253

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.702	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.317	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.17	KM Standard Error of Mean	2.468
KM SD	8.783	95% KM (BCA) UCL	8.026
95% KM (t) UCL	7.449	95% KM (Percentile Bootstrap) UCL	7.21
95% KM (z) UCL	7.229	95% KM Bootstrap t UCL	267.5
90% KM Chebyshev UCL	10.57	95% KM Chebyshev UCL	13.93
97.5% KM Chebyshev UCL	18.58	99% KM Chebyshev UCL	27.72

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.609	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.727	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.369	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.376	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.383	k star (bias corrected MLE)	0.287
Theta hat (MLE)	24.11	Theta star (bias corrected MLE)	32.24
nu hat (MLE)	3.832	nu star (bias corrected)	2.866
Mean (detects)	9.24		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.439
Maximum	36	Median	0.01
SD	8.393	CV	3.441
k hat (MLE)	0.18	k star (bias corrected MLE)	0.187
Theta hat (MLE)	13.55	Theta star (bias corrected MLE)	13.06
nu hat (MLE)	6.841	nu star (bias corrected)	7.094
Adjusted Level of Significance (β)	0.0369		
Approximate Chi Square Value (7.09, α)	2.222	Adjusted Chi Square Value (7.09, β)	1.992
95% Gamma Approximate UCL (use when n>=50)	7.785	95% Gamma Adjusted UCL (use when n<50)	8.687

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbon tetrachloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.17	SD (KM)	8.783
Variance (KM)	77.14	SE of Mean (KM)	2.468
k hat (KM)	0.13	k star (KM)	0.145
nu hat (KM)	4.949	nu star (KM)	5.501
theta hat (KM)	24.34	theta star (KM)	21.89
80% gamma percentile (KM)	3.349	90% gamma percentile (KM)	9.35
95% gamma percentile (KM)	17.56	99% gamma percentile (KM)	41.58

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.50, α)	1.39	Adjusted Chi Square Value (5.50, β)	1.22
95% Gamma Approximate KM-UCL (use when n>=50)	12.54	95% Gamma Adjusted KM-UCL (use when n<50)	14.3

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.807	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.338	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.529	Mean in Log Scale	-1.636
SD in Original Scale	8.366	SD in Log Scale	1.923
95% t UCL (assumes normality of ROS data)	5.857	95% Percentile Bootstrap UCL	6.297
95% BCA Bootstrap UCL	9.568	95% Bootstrap t UCL	185.8
95% H-UCL (Log ROS)	7.995		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.686	KM Geo Mean	0.503
KM SD (logged)	1.429	95% Critical H Value (KM-Log)	3.271
KM Standard Error of Mean (logged)	0.417	95% H-UCL (KM -Log)	4.21
KM SD (logged)	1.429	95% Critical H Value (KM-Log)	3.271
KM Standard Error of Mean (logged)	0.417		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	30.13	Mean in Log Scale	1.008
SD in Original Scale	78.21	SD in Log Scale	2.33
95% t UCL (Assumes normality)	61.25	95% H-Stat UCL	590

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	7.449

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane)

General Statistics

Total Number of Observations	19	Number of Distinct Observations	17
Number of Detects	10	Number of Non-Detects	9
Number of Distinct Detects	10	Number of Distinct Non-Detects	8
Minimum Detect	0.29	Minimum Non-Detect	0.19
Maximum Detect	110	Maximum Non-Detect	510
Variance Detects	1127	Percent Non-Detects	47.37%
Mean Detects	15.54	SD Detects	33.58
Median Detects	4.7	CV Detects	2.16
Skewness Detects	3.033	Kurtosis Detects	9.37
Mean of Logged Detects	1.299	SD of Logged Detects	1.803

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.493	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.389	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	9.699	KM Standard Error of Mean	6.528
KM SD	25.47	95% KM (BCA) UCL	22.79
95% KM (t) UCL	21.02	95% KM (Percentile Bootstrap) UCL	21.55
95% KM (z) UCL	20.44	95% KM Bootstrap t UCL	79.06
90% KM Chebyshev UCL	29.28	95% KM Chebyshev UCL	38.16
97.5% KM Chebyshev UCL	50.47	99% KM Chebyshev UCL	74.65

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.619	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.787	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.254	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.283	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.448	k star (bias corrected MLE)	0.38
Theta hat (MLE)	34.73	Theta star (bias corrected MLE)	40.9
nu hat (MLE)	8.951	nu star (bias corrected)	7.599
Mean (detects)	15.54		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	8.185
Maximum	110	Median	0.29
SD	25.04	CV	3.06
k hat (MLE)	0.204	k star (bias corrected MLE)	0.207
Theta hat (MLE)	40.15	Theta star (bias corrected MLE)	39.59
nu hat (MLE)	7.746	nu star (bias corrected)	7.856
Adjusted Level of Significance (β)	0.0369		
Approximate Chi Square Value (7.86, α)	2.652	Adjusted Chi Square Value (7.86, β)	2.395
95% Gamma Approximate UCL (use when n>=50)	24.25	95% Gamma Adjusted UCL (use when n<50)	26.85

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	9.699	SD (KM)	25.47
Variance (KM)	649	SE of Mean (KM)	6.528
k hat (KM)	0.145	k star (KM)	0.157
nu hat (KM)	5.509	nu star (KM)	5.972
theta hat (KM)	66.91	theta star (KM)	61.72
80% gamma percentile (KM)	10.96	90% gamma percentile (KM)	28.93
95% gamma percentile (KM)	52.89	99% gamma percentile (KM)	121.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.97, α)	1.626	Adjusted Chi Square Value (5.97, β)	1.437
95% Gamma Approximate KM-UCL (use when n>=50)	35.63	95% Gamma Adjusted KM-UCL (use when n<50)	40.32

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.133	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	8.485	Mean in Log Scale	0.259
SD in Original Scale	24.94	SD in Log Scale	1.889
95% t UCL (assumes normality of ROS data)	18.41	95% Percentile Bootstrap UCL	19.35
95% BCA Bootstrap UCL	25.67	95% Bootstrap t UCL	77.42
95% H-UCL (Log ROS)	46.98		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.458	KM Geo Mean	1.581
KM SD (logged)	1.834	95% Critical H Value (KM-Log)	3.957
KM Standard Error of Mean (logged)	0.508	95% H-UCL (KM -Log)	46.96
KM SD (logged)	1.834	95% Critical H Value (KM-Log)	3.957
KM Standard Error of Mean (logged)	0.508		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	28.28	Mean in Log Scale	1.284
SD in Original Scale	63.53	SD in Log Scale	2.237
95% t UCL (Assumes normality)	53.55	95% H-Stat UCL	517.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	40.32

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tetrachloroethene

General Statistics

Total Number of Observations	19	Number of Distinct Observations	17
Number of Detects	10	Number of Non-Detects	9
Number of Distinct Detects	9	Number of Distinct Non-Detects	8
Minimum Detect	1.3	Minimum Non-Detect	0.27
Maximum Detect	370	Maximum Non-Detect	710
Variance Detects	12912	Percent Non-Detects	47.37%
Mean Detects	59.24	SD Detects	113.6
Median Detects	14.55	CV Detects	1.918
Skewness Detects	2.751	Kurtosis Detects	7.943
Mean of Logged Detects	2.527	SD of Logged Detects	1.965

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.577	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.318	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	35.09	KM Standard Error of Mean	21.29
KM SD	85.22	95% KM (BCA) UCL	72.85
95% KM (t) UCL	72	95% KM (Percentile Bootstrap) UCL	74.46
95% KM (z) UCL	70.1	95% KM Bootstrap t UCL	168.2
90% KM Chebyshev UCL	98.94	95% KM Chebyshev UCL	127.9
97.5% KM Chebyshev UCL	168	99% KM Chebyshev UCL	246.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.584	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.792	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.204	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.284	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.42	k star (bias corrected MLE)	0.361
Theta hat (MLE)	141	Theta star (bias corrected MLE)	164.2
nu hat (MLE)	8.401	nu star (bias corrected)	7.214
Mean (detects)	59.24		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	31.18
Maximum	370	Median	1.3
SD	85.9	CV	2.755
k hat (MLE)	0.175	k star (bias corrected MLE)	0.182
Theta hat (MLE)	178.1	Theta star (bias corrected MLE)	170.9
nu hat (MLE)	6.652	nu star (bias corrected)	6.935
Adjusted Level of Significance (β)	0.0369		
Approximate Chi Square Value (6.93, α)	2.135	Adjusted Chi Square Value (6.93, β)	1.91
95% Gamma Approximate UCL (use when n>=50)	101.3	95% Gamma Adjusted UCL (use when n<50)	113.2

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tetrachloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	35.09	SD (KM)	85.22
Variance (KM)	7263	SE of Mean (KM)	21.29
k hat (KM)	0.169	k star (KM)	0.178
nu hat (KM)	6.441	nu star (KM)	6.757
theta hat (KM)	207	theta star (KM)	197.3
80% gamma percentile (KM)	43.2	90% gamma percentile (KM)	105.7
95% gamma percentile (KM)	186.1	99% gamma percentile (KM)	412

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.76, α)	2.038	Adjusted Chi Square Value (6.76, β)	1.82
95% Gamma Approximate KM-UCL (use when n>=50)	116.3	95% Gamma Adjusted KM-UCL (use when n<50)	130.3

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	31.88	Mean in Log Scale	1.266
SD in Original Scale	85.64	SD in Log Scale	2.133
95% t UCL (assumes normality of ROS data)	65.95	95% Percentile Bootstrap UCL	69.74
95% BCA Bootstrap UCL	89.95	95% Bootstrap t UCL	169.7
95% H-UCL (Log ROS)	328.8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.345	KM Geo Mean	3.839
KM SD (logged)	2.195	95% Critical H Value (KM-Log)	4.599
KM Standard Error of Mean (logged)	0.598	95% H-UCL (KM -Log)	461.2
KM SD (logged)	2.195	95% Critical H Value (KM-Log)	4.599
KM Standard Error of Mean (logged)	0.598		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	60.71	Mean in Log Scale	2.153
SD in Original Scale	112.4	SD in Log Scale	2.427
95% t UCL (Assumes normality)	105.4	95% H-Stat UCL	2885

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	130.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	19	Number of Distinct Observations	19
Number of Detects	17	Number of Non-Detects	2
Number of Distinct Detects	17	Number of Distinct Non-Detects	2
Minimum Detect	0.75	Minimum Non-Detect	0.19
Maximum Detect	56000	Maximum Non-Detect	20
Variance Detects	2.145E+8	Percent Non-Detects	10.53%
Mean Detects	6628	SD Detects	14647
Median Detects	590	CV Detects	2.21
Skewness Detects	2.852	Kurtosis Detects	8.494
Mean of Logged Detects	5.6	SD of Logged Detects	3.56

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.53	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.892	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.363	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.207	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5930	KM Standard Error of Mean	3215
KM SD	13594	95% KM (BCA) UCL	11605
95% KM (t) UCL	11505	95% KM (Percentile Bootstrap) UCL	11688
95% KM (z) UCL	11218	95% KM Bootstrap t UCL	21853
90% KM Chebyshev UCL	15574	95% KM Chebyshev UCL	19943
97.5% KM Chebyshev UCL	26006	99% KM Chebyshev UCL	37916

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.582	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.875	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.238	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.231	Detected Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.226	k star (bias corrected MLE)	0.225
Theta hat (MLE)	29362	Theta star (bias corrected MLE)	29443
nu hat (MLE)	7.675	nu star (bias corrected)	7.654
Mean (detects)	6628		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5930
Maximum	56000	Median	520
SD	13967	CV	2.355
k hat (MLE)	0.18	k star (bias corrected MLE)	0.186
Theta hat (MLE)	32988	Theta star (bias corrected MLE)	31802
nu hat (MLE)	6.831	nu star (bias corrected)	7.086
Adjusted Level of Significance (β)	0.0369		
Approximate Chi Square Value (7.09, α)	2.218	Adjusted Chi Square Value (7.09, β)	1.987
95% Gamma Approximate UCL (use when n>=50)	18947	95% Gamma Adjusted UCL (use when n<50)	21143

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5930	SD (KM)	13594
Variance (KM)	1.848E+8	SE of Mean (KM)	3215
k hat (KM)	0.19	k star (KM)	0.195
nu hat (KM)	7.231	nu star (KM)	7.423
theta hat (KM)	31163	theta star (KM)	30359
80% gamma percentile (KM)	7717	90% gamma percentile (KM)	17932
95% gamma percentile (KM)	30743	99% gamma percentile (KM)	66151

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.42, α)	2.406	Adjusted Chi Square Value (7.42, β)	2.163
95% Gamma Approximate KM-UCL (use when n>=50)	18299	95% Gamma Adjusted KM-UCL (use when n<50)	20349

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.892	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.183	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.207	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5930	Mean in Log Scale	4.91
SD in Original Scale	13967	SD in Log Scale	4.001
95% t UCL (assumes normality of ROS data)	11487	95% Percentile Bootstrap UCL	11529
95% BCA Bootstrap UCL	14085	95% Bootstrap t UCL	23323
95% H-UCL (Log ROS)	5.768E+8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.948	KM Geo Mean	140.8
KM SD (logged)	3.808	95% Critical H Value (KM-Log)	7.464
KM Standard Error of Mean (logged)	0.904	95% H-UCL (KM -Log)	1.614E+8
KM SD (logged)	3.808	95% Critical H Value (KM-Log)	7.464
KM Standard Error of Mean (logged)	0.904		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5931	Mean in Log Scale	5.008
SD in Original Scale	13967	SD in Log Scale	3.875
95% t UCL (Assumes normality)	11487	95% H-Stat UCL	2.683E+8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	20349

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride

General Statistics

Total Number of Observations	19	Number of Distinct Observations	14
Number of Detects	5	Number of Non-Detects	14
Number of Distinct Detects	5	Number of Distinct Non-Detects	9
Minimum Detect	0.3	Minimum Non-Detect	0.18
Maximum Detect	370	Maximum Non-Detect	540
Variance Detects	25498	Percent Non-Detects	73.68%
Mean Detects	85.88	SD Detects	159.7
Median Detects	14	CV Detects	1.859
Skewness Detects	2.178	Kurtosis Detects	4.78
Mean of Logged Detects	2.444	SD of Logged Detects	2.682

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.638	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.408	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	24.52	KM Standard Error of Mean	22.28
KM SD	84.44	95% KM (BCA) UCL	73.94
95% KM (t) UCL	63.14	95% KM (Percentile Bootstrap) UCL	63.65
95% KM (z) UCL	61.16	95% KM Bootstrap t UCL	391.6
90% KM Chebyshev UCL	91.34	95% KM Chebyshev UCL	121.6
97.5% KM Chebyshev UCL	163.6	99% KM Chebyshev UCL	246.2

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.265	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.734	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.378	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.337	k star (bias corrected MLE)	0.268
Theta hat (MLE)	255	Theta star (bias corrected MLE)	320.4
nu hat (MLE)	3.368	nu star (bias corrected)	2.68
Mean (detects)	85.88		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	22.61
Maximum	370	Median	0.01
SD	84.71	CV	3.747
k hat (MLE)	0.133	k star (bias corrected MLE)	0.147
Theta hat (MLE)	169.7	Theta star (bias corrected MLE)	153.5
nu hat (MLE)	5.062	nu star (bias corrected)	5.596
Adjusted Level of Significance (β)	0.0369		
Approximate Chi Square Value (5.60, α)	1.437	Adjusted Chi Square Value (5.60, β)	1.262
95% Gamma Approximate UCL (use when n>=50)	88.04	95% Gamma Adjusted UCL (use when n<50)	100.2

Table B.18.2

Summary of ProUCL Output for EU9-EU15 Soil Vapor (Dryden Rd.)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/12/2019 2:36:38 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	24.52	SD (KM)	84.44
Variance (KM)	7130	SE of Mean (KM)	22.28
k hat (KM)	0.0843	k star (KM)	0.106
nu hat (KM)	3.203	nu star (KM)	4.031
theta hat (KM)	290.8	theta star (KM)	231.1
80% gamma percentile (KM)	18.47	90% gamma percentile (KM)	66.77
95% gamma percentile (KM)	141.7	99% gamma percentile (KM)	378

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.03, α)	0.734	Adjusted Chi Square Value (4.03, β)	0.624
95% Gamma Approximate KM-UCL (use when n>=50)	134.6	95% Gamma Adjusted KM-UCL (use when n<50)	158.4

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.998	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.129	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	22.63	Mean in Log Scale	-2.341
SD in Original Scale	84.7	SD in Log Scale	3.478
95% t UCL (assumes normality of ROS data)	56.32	95% Percentile Bootstrap UCL	61.4
95% BCA Bootstrap UCL	81.07	95% Bootstrap t UCL	590.3
95% H-UCL (Log ROS)	12411		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.364	KM Geo Mean	0.695
KM SD (logged)	2.272	95% Critical H Value (KM-Log)	4.739
KM Standard Error of Mean (logged)	0.632	95% H-UCL (KM -Log)	116.3
KM SD (logged)	2.272	95% Critical H Value (KM-Log)	4.739
KM Standard Error of Mean (logged)	0.632		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	44.58	Mean in Log Scale	0.981
SD in Original Scale	101.6	SD in Log Scale	2.681
95% t UCL (Assumes normality)	85	95% H-Stat UCL	3111

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	158.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.1

Summary of ProUCL Input Data for EU18-EU19 Soil Vapor (Central)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

		0	1	2	3	4	5	6	7	8	9	10
Sample Location:	**Sample Date:**	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzene	D_Benzene	Chlorobenzene	D_Chlorobenzene	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	Dichlorodifluoromethane (CFC-12)	D_Dichlorodifluoromethane (CFC-12)	Ethylbenzene
GP02-09	8/15/2018	5.2	0	9.6	1	3.1	0	2.5	0	330	1	4.2
GP03-09	8/14/2018	0.38	0	0.57	1	0.23	0	18	1	1.1	1	3.2
GP04-09	8/14/2018	3.8	0	3	1	2.3	0	1.9	0	9.8	1	24
GP05-09	8/14/2018	0.38	0	0.41	1	0.23	0	0.19	0	570	1	2.9
GP21-09	8/14/2018	7.7	0	15	1	4.5	0	3.7	0	6.7	0	5.9
GP25-18	8/14/2018	7.7	0	3.6	0	4.7	1	3.7	0	12	1	5.9
GP26-18	8/14/2018	17	0	52	1	22	1	8.3	0	15	0	13
GP27-18	8/15/2018	74	1	410	1	9200	1	21	0	38	0	150
GP28-18	8/15/2018	15	0	120	1	2200	1	7.2	0	13	0	13
GP29-18	8/15/2018	7.7	0	40	1	4.5	0	3.7	0	51	1	14
GP32-18	8/24/2018	3.8	0	3.6	1	2.3	0	8	1	29	1	3

Table B.19.1

Summary of ProUCL Input Data for EU18-EU19 Soil Vapor (Central)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

		11	12	13	14	15	16	17	18	19	20	21	22	23
Sample Location:	**Sample Date:**	D_Ethylbenzene	Hexane	D_Hexane	N-Heptane	D_N-Heptane	Tetrachloroethene	D_Tetrachloroethene	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Xylenes (total)	D_Xylenes (total)
GP02-09	8/15/2018	1	220	1	130	1	3.7	0	2.6	0	65	1	22.8	1
GP03-09	8/14/2018	1	0.92	1	0.57	1	550	1	120	1	0.18	0	21	1
GP04-09	8/14/2018	1	22	1	5	1	2.7	0	1.9	0	1.8	0	112	1
GP05-09	8/14/2018	1	0.94	1	0.54	1	7	1	0.19	0	0.18	0	18.4	1
GP21-09	8/14/2018	0	52	1	4	1	5.4	0	3.9	0	3.6	0	10	0
GP25-18	8/14/2018	0	38	1	7.7	1	5.4	0	3.9	0	75	1	19.1	1
GP26-18	8/14/2018	0	140	1	50	1	12	0	110	1	77	1	72	1
GP27-18	8/15/2018	1	3100	1	1800	1	31	0	22	0	21	0	660	1
GP28-18	8/15/2018	1	1400	1	520	1	11	0	11	1	200	1	107	1
GP29-18	8/15/2018	1	790	1	400	1	68	1	17	1	53	1	28	1
GP32-18	8/24/2018	0	2.1	1	1.9	0	2.7	0	590	1	1.8	0	5.2	0

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,4-Dichlorobenzene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	7
Number of Detects	1	Number of Non-Detects	10
Number of Distinct Detects	1	Number of Distinct Non-Detects	6

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,4-Dichlorobenzene was not processed!

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
Number of Detects	10	Number of Non-Detects	1
Number of Distinct Detects	10	Number of Distinct Non-Detects	1
Minimum Detect	0.41	Minimum Non-Detect	3.6
Maximum Detect	410	Maximum Non-Detect	3.6
Variance Detects	16039	Percent Non-Detects	9.091%
Mean Detects	65.42	SD Detects	126.6
Median Detects	12.3	CV Detects	1.936
Skewness Detects	2.717	Kurtosis Detects	7.699
Mean of Logged Detects	2.434	SD of Logged Detects	2.248

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.581	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.342	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	59.59	KM Standard Error of Mean	36.88
KM SD	116	95% KM (BCA) UCL	130.7
95% KM (t) UCL	126.4	95% KM (Percentile Bootstrap) UCL	125.7
95% KM (z) UCL	120.2	95% KM Bootstrap t UCL	345.3
90% KM Chebyshev UCL	170.2	95% KM Chebyshev UCL	220.3
97.5% KM Chebyshev UCL	289.9	99% KM Chebyshev UCL	426.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.338	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.799	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.165	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.285	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.38	k star (bias corrected MLE)	0.333
Theta hat (MLE)	172.2	Theta star (bias corrected MLE)	196.7
nu hat (MLE)	7.597	nu star (bias corrected)	6.651
Mean (detects)	65.42		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	59.47
Maximum	410	Median	9.6
SD	121.8	CV	2.047
k hat (MLE)	0.301	k star (bias corrected MLE)	0.279
Theta hat (MLE)	197.7	Theta star (bias corrected MLE)	212.9
nu hat (MLE)	6.618	nu star (bias corrected)	6.146
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (6.15, α)	1.715	Adjusted Chi Square Value (6.15, β)	1.362
95% Gamma Approximate UCL (use when n>=50)	213.1	95% Gamma Adjusted UCL (use when n<50)	268.3

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	59.59	SD (KM)	116
Variance (KM)	13462	SE of Mean (KM)	36.88
k hat (KM)	0.264	k star (KM)	0.252
nu hat (KM)	5.803	nu star (KM)	5.554
theta hat (KM)	225.9	theta star (KM)	236.1
80% gamma percentile (KM)	86.84	90% gamma percentile (KM)	178.7
95% gamma percentile (KM)	287.6	99% gamma percentile (KM)	577

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.55, α)	1.416	Adjusted Chi Square Value (5.55, β)	1.106
95% Gamma Approximate KM-UCL (use when n>=50)	233.7	95% Gamma Adjusted KM-UCL (use when n<50)	299.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.971	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.112	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	59.55	Mean in Log Scale	2.199
SD in Original Scale	121.7	SD in Log Scale	2.271
95% t UCL (assumes normality of ROS data)	126.1	95% Percentile Bootstrap UCL	126.8
95% BCA Bootstrap UCL	166.6	95% Bootstrap t UCL	383.1
95% H-UCL (Log ROS)	7516		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.202	KM Geo Mean	9.042
KM SD (logged)	2.178	95% Critical H Value (KM-Log)	5.563
KM Standard Error of Mean (logged)	0.699	95% H-UCL (KM -Log)	4470
KM SD (logged)	2.178	95% Critical H Value (KM-Log)	5.563
KM Standard Error of Mean (logged)	0.699		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	59.63	Mean in Log Scale	2.266
SD in Original Scale	121.7	SD in Log Scale	2.205
95% t UCL (Assumes normality)	126.1	95% H-Stat UCL	5523

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	345.3	Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	299.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chlorobenzene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	8
Number of Detects	4	Number of Non-Detects	7
Number of Distinct Detects	4	Number of Distinct Non-Detects	4
Minimum Detect	4.7	Minimum Non-Detect	0.23
Maximum Detect	9200	Maximum Non-Detect	4.5
Variance Detects	18946046	Percent Non-Detects	63.64%
Mean Detects	2857	SD Detects	4353
Median Detects	1111	CV Detects	1.524
Skewness Detects	1.689	Kurtosis Detects	2.751
Mean of Logged Detects	5.365	SD of Logged Detects	3.621

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.786	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.31	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1039	KM Standard Error of Mean	924.8
KM SD	2656	95% KM (BCA) UCL	N/A
95% KM (t) UCL	2715	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	2560	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	3813	95% KM Chebyshev UCL	5070
97.5% KM Chebyshev UCL	6814	99% KM Chebyshev UCL	10240

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.335	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.712	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.292	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.42	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.271	k star (bias corrected MLE)	0.234
Theta hat (MLE)	10559	Theta star (bias corrected MLE)	12192
nu hat (MLE)	2.164	nu star (bias corrected)	1.874
Mean (detects)	2857		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1039
Maximum	9200	Median	0.01
SD	2786	CV	2.682
k hat (MLE)	0.102	k star (bias corrected MLE)	0.135
Theta hat (MLE)	10165	Theta star (bias corrected MLE)	7699
nu hat (MLE)	2.248	nu star (bias corrected)	2.968
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (2.97, α)	0.363	Adjusted Chi Square Value (2.97, β)	0.255
95% Gamma Approximate UCL (use when n>=50)	8492	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chlorobenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1039	SD (KM)	2656
Variance (KM)	7055201	SE of Mean (KM)	924.8
k hat (KM)	0.153	k star (KM)	0.172
nu hat (KM)	3.366	nu star (KM)	3.781
theta hat (KM)	6791	theta star (KM)	6045
80% gamma percentile (KM)	1251	90% gamma percentile (KM)	3125
95% gamma percentile (KM)	5556	99% gamma percentile (KM)	12427

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.78, α)	0.637	Adjusted Chi Square Value (3.78, β)	0.463
95% Gamma Approximate KM-UCL (use when n>=50)	6165	95% Gamma Adjusted KM-UCL (use when n<50)	8491

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1039	Mean in Log Scale	-2.88
SD in Original Scale	2786	SD in Log Scale	7.147
95% t UCL (assumes normality of ROS data)	2561	95% Percentile Bootstrap UCL	2512
95% BCA Bootstrap UCL	3546	95% Bootstrap t UCL	436551
95% H-UCL (Log ROS)	9.510E+26		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.016	KM Geo Mean	2.762
KM SD (logged)	3.793	95% Critical H Value (KM-Log)	9.37
KM Standard Error of Mean (logged)	1.321	95% H-UCL (KM -Log)	2.792E+8
KM SD (logged)	3.793	95% Critical H Value (KM-Log)	9.37
KM Standard Error of Mean (logged)	1.321		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1040	Mean in Log Scale	1.771
SD in Original Scale	2786	SD in Log Scale	3.618
95% t UCL (Assumes normality)	2562	95% H-Stat UCL	1.143E+8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2715

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane)

General Statistics

Total Number of Observations	11	Number of Distinct Observations	9
Number of Detects	2	Number of Non-Detects	9
Number of Distinct Detects	2	Number of Distinct Non-Detects	7
Minimum Detect	8	Minimum Non-Detect	0.19
Maximum Detect	18	Maximum Non-Detect	21
Variance Detects	50	Percent Non-Detects	81.82%
Mean Detects	13	SD Detects	7.071
Median Detects	13	CV Detects	0.544
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	2.485	SD of Logged Detects	0.573

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.85	KM Standard Error of Mean	2.54
KM SD	5.613	95% KM (BCA) UCL	N/A
95% KM (t) UCL	7.453	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	7.028	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	10.47	95% KM Chebyshev UCL	13.92
97.5% KM Chebyshev UCL	18.71	99% KM Chebyshev UCL	28.12

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	6.409	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2.028	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	25.63	nu star (bias corrected)	N/A
Mean (detects)	13		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.85	SD (KM)	5.613
Variance (KM)	31.51	SE of Mean (KM)	2.54
k hat (KM)	0.258	k star (KM)	0.248
nu hat (KM)	5.67	nu star (KM)	5.457
theta hat (KM)	11.06	theta star (KM)	11.49
80% gamma percentile (KM)	4.127	90% gamma percentile (KM)	8.558
95% gamma percentile (KM)	13.83	99% gamma percentile (KM)	27.86

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0278
Approximate Chi Square Value (5.46, α)	1.369	Adjusted Chi Square Value (5.46, β)	1.066
95% Gamma Approximate KM-UCL (use when n>=50)	11.36	95% Gamma Adjusted KM-UCL (use when n<50)	14.59

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.779	Mean in Log Scale	0.854
SD in Original Scale	5.106	SD in Log Scale	0.89
95% t UCL (assumes normality of ROS data)	6.569	95% Percentile Bootstrap UCL	6.325
95% BCA Bootstrap UCL	8.165	95% Bootstrap t UCL	21.56
95% H-UCL (Log ROS)	7.661		

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane) (cont.d')

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.785	KM Geo Mean	0.456
KM SD (logged)	1.696	95% Critical H Value (KM-Log)	4.466
KM Standard Error of Mean (logged)	0.781	95% H-UCL (KM -Log)	21.12
KM SD (logged)	1.696	95% Critical H Value (KM-Log)	4.466
KM Standard Error of Mean (logged)	0.781		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.736	Mean in Log Scale	0.881
SD in Original Scale	5.426	SD in Log Scale	1.417
95% t UCL (Assumes normality)	7.701	95% H-Stat UCL	36.95

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	13.92

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dichlorodifluoromethane (CFC-12)

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
Number of Detects	7	Number of Non-Detects	4
Number of Distinct Detects	7	Number of Distinct Non-Detects	4
Minimum Detect	1.1	Minimum Non-Detect	6.7
Maximum Detect	570	Maximum Non-Detect	38
Variance Detects	48966	Percent Non-Detects	36.36%
Mean Detects	143.3	SD Detects	221.3
Median Detects	29	CV Detects	1.545
Skewness Detects	1.603	Kurtosis Detects	1.537
Mean of Logged Detects	3.472	SD of Logged Detects	2.148

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.711	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.376	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	93.21	KM Standard Error of Mean	57.46
KM SD	176.4	95% KM (BCA) UCL	197
95% KM (t) UCL	197.3	95% KM (Percentile Bootstrap) UCL	187.9
95% KM (z) UCL	187.7	95% KM Bootstrap t UCL	1048
90% KM Chebyshev UCL	265.6	95% KM Chebyshev UCL	343.7
97.5% KM Chebyshev UCL	452	99% KM Chebyshev UCL	664.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.378	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.762	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.235	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.33	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.435	k star (bias corrected MLE)	0.344
Theta hat (MLE)	329.3	Theta star (bias corrected MLE)	416.7
nu hat (MLE)	6.09	nu star (bias corrected)	4.814
Mean (detects)	143.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	91.18
Maximum	570	Median	9.8
SD	186	CV	2.04
k hat (MLE)	0.187	k star (bias corrected MLE)	0.197
Theta hat (MLE)	487.7	Theta star (bias corrected MLE)	463.8
nu hat (MLE)	4.113	nu star (bias corrected)	4.325
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (4.32, α)	0.854	Adjusted Chi Square Value (4.32, β)	0.636
95% Gamma Approximate UCL (use when n>=50)	461.7	95% Gamma Adjusted UCL (use when n<50)	619.6

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dichlorodifluoromethane (CFC-12) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	93.21	SD (KM)	176.4
Variance (KM)	31110	SE of Mean (KM)	57.46
k hat (KM)	0.279	k star (KM)	0.264
nu hat (KM)	6.144	nu star (KM)	5.801
theta hat (KM)	333.8	theta star (KM)	353.5
80% gamma percentile (KM)	137.8	90% gamma percentile (KM)	278.6
95% gamma percentile (KM)	444	99% gamma percentile (KM)	881

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.80, α)	1.539	Adjusted Chi Square Value (5.80, β)	1.211
95% Gamma Approximate KM-UCL (use when n>=50)	351.3	95% Gamma Adjusted KM-UCL (use when n<50)	446.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.963	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	92.41	Mean in Log Scale	2.597
SD in Original Scale	185.4	SD in Log Scale	2.098
95% t UCL (assumes normality of ROS data)	193.7	95% Percentile Bootstrap UCL	190.1
95% BCA Bootstrap UCL	226.1	95% Bootstrap t UCL	1063
95% H-UCL (Log ROS)	4293		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.584	KM Geo Mean	13.25
KM SD (logged)	2.098	95% Critical H Value (KM-Log)	5.378
KM Standard Error of Mean (logged)	0.731	95% H-UCL (KM -Log)	4241
KM SD (logged)	2.098	95% Critical H Value (KM-Log)	5.378
KM Standard Error of Mean (logged)	0.731		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	94.48	Mean in Log Scale	2.941
SD in Original Scale	184.3	SD in Log Scale	1.862
95% t UCL (Assumes normality)	195.2	95% H-Stat UCL	1850

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	1048	Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	446.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	9
Number of Detects	7	Number of Non-Detects	4
Number of Distinct Detects	7	Number of Distinct Non-Detects	3
Minimum Detect	2.9	Minimum Non-Detect	3
Maximum Detect	150	Maximum Non-Detect	13
Variance Detects	2850	Percent Non-Detects	36.36%
Mean Detects	30.19	SD Detects	53.38
Median Detects	13	CV Detects	1.769
Skewness Detects	2.535	Kurtosis Detects	6.539
Mean of Logged Detects	2.437	SD of Logged Detects	1.399

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.577	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.403	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	20.37	KM Standard Error of Mean	13.52
KM SD	41.51	95% KM (BCA) UCL	46.85
95% KM (t) UCL	44.88	95% KM (Percentile Bootstrap) UCL	45.03
95% KM (z) UCL	42.61	95% KM Bootstrap t UCL	157.6
90% KM Chebyshev UCL	60.93	95% KM Chebyshev UCL	79.3
97.5% KM Chebyshev UCL	104.8	99% KM Chebyshev UCL	154.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.685	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.743	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.257	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.325	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.632	k star (bias corrected MLE)	0.456
Theta hat (MLE)	47.79	Theta star (bias corrected MLE)	66.17
nu hat (MLE)	8.843	nu star (bias corrected)	6.387
Mean (detects)	30.19		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	19.21
Maximum	150	Median	3.2
SD	44.06	CV	2.294
k hat (MLE)	0.233	k star (bias corrected MLE)	0.23
Theta hat (MLE)	82.38	Theta star (bias corrected MLE)	83.45
nu hat (MLE)	5.131	nu star (bias corrected)	5.065
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (5.06, α)	1.182	Adjusted Chi Square Value (5.06, β)	0.908
95% Gamma Approximate UCL (use when n>=50)	82.31	95% Gamma Adjusted UCL (use when n<50)	107.2

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	20.37	SD (KM)	41.51
Variance (KM)	1723	SE of Mean (KM)	13.52
k hat (KM)	0.241	k star (KM)	0.236
nu hat (KM)	5.299	nu star (KM)	5.187
theta hat (KM)	84.58	theta star (KM)	86.4
80% gamma percentile (KM)	28.95	90% gamma percentile (KM)	61.37
95% gamma percentile (KM)	100.3	99% gamma percentile (KM)	204.9

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.19, α)	1.24	Adjusted Chi Square Value (5.19, β)	0.956
95% Gamma Approximate KM-UCL (use when n>=50)	85.25	95% Gamma Adjusted KM-UCL (use when n<50)	110.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.192	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	20.21	Mean in Log Scale	1.878
SD in Original Scale	43.61	SD in Log Scale	1.365
95% t UCL (assumes normality of ROS data)	44.04	95% Percentile Bootstrap UCL	44.59
95% BCA Bootstrap UCL	59.94	95% Bootstrap t UCL	171.5
95% H-UCL (Log ROS)	83.48		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.97	KM Geo Mean	7.168
KM SD (logged)	1.207	95% Critical H Value (KM-Log)	3.41
KM Standard Error of Mean (logged)	0.394	95% H-UCL (KM -Log)	54.52
KM SD (logged)	1.207	95% Critical H Value (KM-Log)	3.41
KM Standard Error of Mean (logged)	0.394		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	20.47	Mean in Log Scale	1.954
SD in Original Scale	43.51	SD in Log Scale	1.315
95% t UCL (Assumes normality)	44.25	95% H-Stat UCL	76.03

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	157.6	Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	110.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Hexane

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	0.92	Mean	524.2
Maximum	3100	Median	52
SD	961.5	Std. Error of Mean	289.9
Coefficient of Variation	1.834	Skewness	2.327

Normal GOF Test

Shapiro Wilk Test Statistic	0.63	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.351	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.251	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1050	95% Adjusted-CLT UCL (Chen-1995)	1218
		95% Modified-t UCL (Johnson-1978)	1083

Gamma GOF Test

A-D Test Statistic	0.332	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.82	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.16	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.276	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.3	k star (bias corrected MLE)	0.279
Theta hat (MLE)	1749	Theta star (bias corrected MLE)	1882
nu hat (MLE)	6.594	nu star (bias corrected)	6.129
MLE Mean (bias corrected)	524.2	MLE Sd (bias corrected)	993.1
		Approximate Chi Square Value (0.05)	1.706
Adjusted Level of Significance	0.0278	Adjusted Chi Square Value	1.355

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1883	95% Adjusted Gamma UCL (use when n<50)	2372

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.85	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.143	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.251	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.0834	Mean of logged Data	3.961
Maximum of Logged Data	8.039	SD of logged Data	2.856

Assuming Lognormal Distribution

95% H-UCL	1965401	90% Chebyshev (MVUE) UCL	3661
95% Chebyshev (MVUE) UCL	4841	97.5% Chebyshev (MVUE) UCL	6479
99% Chebyshev (MVUE) UCL	9697		

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Hexane (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1001	95% Jackknife UCL	1050
95% Standard Bootstrap UCL	988.8	95% Bootstrap-t UCL	2158
95% Hall's Bootstrap UCL	2601	95% Percentile Bootstrap UCL	1000
95% BCA Bootstrap UCL	1196		
90% Chebyshev(Mean, Sd) UCL	1394	95% Chebyshev(Mean, Sd) UCL	1788
97.5% Chebyshev(Mean, Sd) UCL	2335	99% Chebyshev(Mean, Sd) UCL	3409

Suggested UCL to Use

95% Adjusted Gamma UCL	2372

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

N-Heptane

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
Number of Detects	10	Number of Non-Detects	1
Number of Distinct Detects	10	Number of Distinct Non-Detects	1
Minimum Detect	0.54	Minimum Non-Detect	1.9
Maximum Detect	1800	Maximum Non-Detect	1.9
Variance Detects	315393	Percent Non-Detects	9.091%
Mean Detects	291.8	SD Detects	561.6
Median Detects	28.85	CV Detects	1.925
Skewness Detects	2.592	Kurtosis Detects	7.105
Mean of Logged Detects	3.238	SD of Logged Detects	2.881

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.6	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.313	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	265.3	KM Standard Error of Mean	163.6
KM SD	514.8	95% KM (BCA) UCL	551.4
95% KM (t) UCL	561.9	95% KM (Percentile Bootstrap) UCL	552.9
95% KM (z) UCL	534.4	95% KM Bootstrap t UCL	1146
90% KM Chebyshev UCL	756.2	95% KM Chebyshev UCL	978.5
97.5% KM Chebyshev UCL	1287	99% KM Chebyshev UCL	1893

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.413	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.82	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.225	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.289	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.285	k star (bias corrected MLE)	0.266
Theta hat (MLE)	1023	Theta star (bias corrected MLE)	1096
nu hat (MLE)	5.704	nu star (bias corrected)	5.326
Mean (detects)	291.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	265.3
Maximum	1800	Median	7.7
SD	540	CV	2.036
k hat (MLE)	0.235	k star (bias corrected MLE)	0.231
Theta hat (MLE)	1130	Theta star (bias corrected MLE)	1146
nu hat (MLE)	5.165	nu star (bias corrected)	5.09
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (5.09, α)	1.194	Adjusted Chi Square Value (5.09, β)	0.918
95% Gamma Approximate UCL (use when n>=50)	1131	95% Gamma Adjusted UCL (use when n<50)	1471

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

N-Heptane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	265.3	SD (KM)	514.8
Variance (KM)	265058	SE of Mean (KM)	163.6
k hat (KM)	0.266	k star (KM)	0.254
nu hat (KM)	5.842	nu star (KM)	5.582
theta hat (KM)	999.1	theta star (KM)	1046
80% gamma percentile (KM)	387.3	90% gamma percentile (KM)	795.5
95% gamma percentile (KM)	1279	99% gamma percentile (KM)	2562

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.58, α)	1.43	Adjusted Chi Square Value (5.58, β)	1.118
95% Gamma Approximate KM-UCL (use when n>=50)	1036	95% Gamma Adjusted KM-UCL (use when n<50)	1325

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.161	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	265.3	Mean in Log Scale	2.873
SD in Original Scale	540	SD in Log Scale	2.99
95% t UCL (assumes normality of ROS data)	560.4	95% Percentile Bootstrap UCL	551.4
95% BCA Bootstrap UCL	703.2	95% Bootstrap t UCL	1194
95% H-UCL (Log ROS)	1797217		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.89	KM Geo Mean	17.99
KM SD (logged)	2.829	95% Critical H Value (KM-Log)	7.084
KM Standard Error of Mean (logged)	0.899	95% H-UCL (KM -Log)	556569
KM SD (logged)	2.829	95% Critical H Value (KM-Log)	7.084
KM Standard Error of Mean (logged)	0.899		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	265.3	Mean in Log Scale	2.939
SD in Original Scale	539.9	SD in Log Scale	2.908
95% t UCL (Assumes normality)	560.4	95% H-Stat UCL	1037729

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	1146	Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	1325

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tetrachloroethene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	9
Number of Detects	3	Number of Non-Detects	8
Number of Distinct Detects	3	Number of Distinct Non-Detects	6
Minimum Detect	7	Minimum Non-Detect	2.7
Maximum Detect	550	Maximum Non-Detect	31
Variance Detects	88482	Percent Non-Detects	72.73%
Mean Detects	208.3	SD Detects	297.5
Median Detects	68	CV Detects	1.428
Skewness Detects	1.65	Kurtosis Detects	N/A
Mean of Logged Detects	4.158	SD of Logged Detects	2.183

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.833	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.348	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	58.98	KM Standard Error of Mean	57.75
KM SD	156.4	95% KM (BCA) UCL	N/A
95% KM (t) UCL	163.6	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	154	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	232.2	95% KM Chebyshev UCL	310.7
97.5% KM Chebyshev UCL	419.6	99% KM Chebyshev UCL	633.6

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.533	k star (bias corrected MLE)	N/A
Theta hat (MLE)	391.1	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.196	nu star (bias corrected)	N/A
Mean (detects)	208.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	56.83
Maximum	550	Median	0.01
SD	164.8	CV	2.9
k hat (MLE)	0.126	k star (bias corrected MLE)	0.152
Theta hat (MLE)	451.2	Theta star (bias corrected MLE)	373.3
nu hat (MLE)	2.771	nu star (bias corrected)	3.349
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (3.35, α)	0.483	Adjusted Chi Square Value (3.35, β)	0.343
95% Gamma Approximate UCL (use when n>=50)	394.2	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Tetrachloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	58.98	SD (KM)	156.4
Variance (KM)	24454	SE of Mean (KM)	57.75
k hat (KM)	0.142	k star (KM)	0.164
nu hat (KM)	3.129	nu star (KM)	3.609
theta hat (KM)	414.6	theta star (KM)	359.5
80% gamma percentile (KM)	68.77	90% gamma percentile (KM)	176.7
95% gamma percentile (KM)	318.7	99% gamma percentile (KM)	723.4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.61, α)	0.574	Adjusted Chi Square Value (3.61, β)	0.413
95% Gamma Approximate KM-UCL (use when n>=50)	371	95% Gamma Adjusted KM-UCL (use when n<50)	515.4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.999	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	56.87	Mean in Log Scale	-1.203
SD in Original Scale	164.8	SD in Log Scale	3.739
95% t UCL (assumes normality of ROS data)	146.9	95% Percentile Bootstrap UCL	151.9
95% BCA Bootstrap UCL	212.4	95% Bootstrap t UCL	4481
95% H-UCL (Log ROS)	18106301		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.9	KM Geo Mean	6.684
KM SD (logged)	1.679	95% Critical H Value (KM-Log)	4.427
KM Standard Error of Mean (logged)	0.626	95% H-UCL (KM -Log)	286.8
KM SD (logged)	1.679	95% Critical H Value (KM-Log)	4.427
KM Standard Error of Mean (logged)	0.626		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	60.18	Mean in Log Scale	1.992
SD in Original Scale	163.6	SD in Log Scale	1.841
95% t UCL (Assumes normality)	149.6	95% H-Stat UCL	651

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	163.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	11	Number of Distinct Observations	10
Number of Detects	5	Number of Non-Detects	6
Number of Distinct Detects	5	Number of Distinct Non-Detects	5
Minimum Detect	11	Minimum Non-Detect	0.19
Maximum Detect	590	Maximum Non-Detect	22
Variance Detects	57797	Percent Non-Detects	54.55%
Mean Detects	169.6	SD Detects	240.4
Median Detects	110	CV Detects	1.418
Skewness Detects	1.992	Kurtosis Detects	4.135
Mean of Logged Detects	4.22	SD of Logged Detects	1.617

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.726	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.382	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	77.55	KM Standard Error of Mean	56.5
KM SD	167.6	95% KM (BCA) UCL	175.2
95% KM (t) UCL	179.9	95% KM (Percentile Bootstrap) UCL	181.9
95% KM (z) UCL	170.5	95% KM Bootstrap t UCL	382
90% KM Chebyshev UCL	247	95% KM Chebyshev UCL	323.8
97.5% KM Chebyshev UCL	430.4	99% KM Chebyshev UCL	639.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.359	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.703	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.239	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.368	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.666	k star (bias corrected MLE)	0.4
Theta hat (MLE)	254.6	Theta star (bias corrected MLE)	424.2
nu hat (MLE)	6.661	nu star (bias corrected)	3.998
Mean (detects)	169.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	77.1
Maximum	590	Median	0.01
SD	176	CV	2.282
k hat (MLE)	0.155	k star (bias corrected MLE)	0.173
Theta hat (MLE)	497.7	Theta star (bias corrected MLE)	445
nu hat (MLE)	3.408	nu star (bias corrected)	3.812
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (3.81, α)	0.649	Adjusted Chi Square Value (3.81, β)	0.472
95% Gamma Approximate UCL (use when n>=50)	453	95% Gamma Adjusted UCL (use when n<50)	622.9

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	77.55	SD (KM)	167.6
Variance (KM)	28083	SE of Mean (KM)	56.5
k hat (KM)	0.214	k star (KM)	0.216
nu hat (KM)	4.712	nu star (KM)	4.76
theta hat (KM)	362.1	theta star (KM)	358.4
80% gamma percentile (KM)	106.2	90% gamma percentile (KM)	234.4
95% gamma percentile (KM)	391.3	99% gamma percentile (KM)	817.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.76, α)	1.043	Adjusted Chi Square Value (4.76, β)	0.792
95% Gamma Approximate KM-UCL (use when n>=50)	353.9	95% Gamma Adjusted KM-UCL (use when n<50)	466.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.217	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	77.64	Mean in Log Scale	1.825
SD in Original Scale	175.7	SD in Log Scale	2.554
95% t UCL (assumes normality of ROS data)	173.7	95% Percentile Bootstrap UCL	173.8
95% BCA Bootstrap UCL	226.6	95% Bootstrap t UCL	423
95% H-UCL (Log ROS)	29312		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.123	KM Geo Mean	3.075
KM SD (logged)	3.065	95% Critical H Value (KM-Log)	7.642
KM Standard Error of Mean (logged)	1.054	95% H-UCL (KM -Log)	555964
KM SD (logged)	3.065	95% Critical H Value (KM-Log)	7.642
KM Standard Error of Mean (logged)	1.054		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	78.66	Mean in Log Scale	2.063
SD in Original Scale	175.2	SD in Log Scale	2.549
95% t UCL (Assumes normality)	174.4	95% H-Stat UCL	35896

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	382	Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	466.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride

General Statistics

Total Number of Observations	11	Number of Distinct Observations	9
Number of Detects	5	Number of Non-Detects	6
Number of Distinct Detects	5	Number of Distinct Non-Detects	4
Minimum Detect	53	Minimum Non-Detect	0.18
Maximum Detect	200	Maximum Non-Detect	21
Variance Detects	3602	Percent Non-Detects	54.55%
Mean Detects	94	SD Detects	60.02
Median Detects	75	CV Detects	0.638
Skewness Detects	2.093	Kurtosis Detects	4.524
Mean of Logged Detects	4.421	SD of Logged Detects	0.512

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.702	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.412	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	42.83	KM Standard Error of Mean	19.92
KM SD	59.09	95% KM (BCA) UCL	75.09
95% KM (t) UCL	78.93	95% KM (Percentile Bootstrap) UCL	74.96
95% KM (z) UCL	75.59	95% KM Bootstrap t UCL	74.43
90% KM Chebyshev UCL	102.6	95% KM Chebyshev UCL	129.7
97.5% KM Chebyshev UCL	167.2	99% KM Chebyshev UCL	241

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.704	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.681	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.392	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.358	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.243	k star (bias corrected MLE)	1.831
Theta hat (MLE)	22.15	Theta star (bias corrected MLE)	51.35
nu hat (MLE)	42.43	nu star (bias corrected)	18.31
Mean (detects)	94		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	42.73
Maximum	200	Median	0.01
SD	62.05	CV	1.452
k hat (MLE)	0.176	k star (bias corrected MLE)	0.189
Theta hat (MLE)	242.5	Theta star (bias corrected MLE)	226.4
nu hat (MLE)	3.878	nu star (bias corrected)	4.153
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (4.15, α)	0.783	Adjusted Chi Square Value (4.15, β)	0.579
95% Gamma Approximate UCL (use when n>=50)	226.6	95% Gamma Adjusted UCL (use when n<50)	306.5

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	42.83	SD (KM)	59.09
Variance (KM)	3492	SE of Mean (KM)	19.92
k hat (KM)	0.525	k star (KM)	0.443
nu hat (KM)	11.55	nu star (KM)	9.736
theta hat (KM)	81.54	theta star (KM)	96.77
80% gamma percentile (KM)	69.81	90% gamma percentile (KM)	118.7
95% gamma percentile (KM)	171.8	99% gamma percentile (KM)	303.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.74, α)	3.778	Adjusted Chi Square Value (9.74, β)	3.196
95% Gamma Approximate KM-UCL (use when n>=50)	110.4	95% Gamma Adjusted KM-UCL (use when n<50)	130.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.812	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.36	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	52.84	Mean in Log Scale	3.586
SD in Original Scale	54.82	SD in Log Scale	0.883
95% t UCL (assumes normality of ROS data)	82.8	95% Percentile Bootstrap UCL	81.07
95% BCA Bootstrap UCL	94.32	95% Bootstrap t UCL	111.1
95% H-UCL (Log ROS)	115.8		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.074	KM Geo Mean	2.927
KM SD (logged)	3.071	95% Critical H Value (KM-Log)	7.656
KM Standard Error of Mean (logged)	1.035	95% H-UCL (KM -Log)	552737
KM SD (logged)	3.071	95% Critical H Value (KM-Log)	7.656
KM Standard Error of Mean (logged)	1.035		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	44.03	Mean in Log Scale	1.82
SD in Original Scale	61.14	SD in Log Scale	2.826
95% t UCL (Assumes normality)	77.44	95% H-Stat UCL	186169

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL 552737

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total)

General Statistics

Total Number of Observations	11	Number of Distinct Observations	11
Number of Detects	9	Number of Non-Detects	2
Number of Distinct Detects	9	Number of Distinct Non-Detects	2
Minimum Detect	18.4	Minimum Non-Detect	5.2
Maximum Detect	660	Maximum Non-Detect	10
Variance Detects	42789	Percent Non-Detects	18.18%
Mean Detects	117.8	SD Detects	206.9
Median Detects	28	CV Detects	1.756
Skewness Detects	2.812	Kurtosis Detects	8.135
Mean of Logged Detects	3.947	SD of Logged Detects	1.206

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.539	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.4	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	97.34	KM Standard Error of Mean	58.1
KM SD	181.7	95% KM (BCA) UCL	208.3
95% KM (t) UCL	202.6	95% KM (Percentile Bootstrap) UCL	205.7
95% KM (z) UCL	192.9	95% KM Bootstrap t UCL	519.7
90% KM Chebyshev UCL	271.6	95% KM Chebyshev UCL	350.6
97.5% KM Chebyshev UCL	460.2	99% KM Chebyshev UCL	675.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.002	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.753	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.273	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.29	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.731	k star (bias corrected MLE)	0.561
Theta hat (MLE)	161.2	Theta star (bias corrected MLE)	209.8
nu hat (MLE)	13.16	nu star (bias corrected)	10.11
Mean (detects)	117.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	96.39
Maximum	660	Median	22.8
SD	191.1	CV	1.982
k hat (MLE)	0.314	k star (bias corrected MLE)	0.289
Theta hat (MLE)	306.5	Theta star (bias corrected MLE)	333.2
nu hat (MLE)	6.918	nu star (bias corrected)	6.365
Adjusted Level of Significance (β)	0.0278		
Approximate Chi Square Value (6.36, α)	1.829	Adjusted Chi Square Value (6.36, β)	1.461
95% Gamma Approximate UCL (use when n>=50)	335.4	95% Gamma Adjusted UCL (use when n<50)	419.9

Table B.19.2

Summary of ProUCL Output for Soil Vapor - Central (EU18 & EU19)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.110/3/2019 11:39:38 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	97.34	SD (KM)	181.7
Variance (KM)	33006	SE of Mean (KM)	58.1
k hat (KM)	0.287	k star (KM)	0.269
nu hat (KM)	6.315	nu star (KM)	5.926
theta hat (KM)	339.1	theta star (KM)	361.3
80% gamma percentile (KM)	144.9	90% gamma percentile (KM)	290.4
95% gamma percentile (KM)	460.6	99% gamma percentile (KM)	909.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.93, α)	1.602	Adjusted Chi Square Value (5.93, β)	1.265
95% Gamma Approximate KM-UCL (use when n>=50)	360	95% Gamma Adjusted KM-UCL (use when n<50)	455.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.832	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.251	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	96.98	Mean in Log Scale	3.442
SD in Original Scale	190.7	SD in Log Scale	1.558
95% t UCL (assumes normality of ROS data)	201.2	95% Percentile Bootstrap UCL	205.8
95% BCA Bootstrap UCL	261.5	95% Bootstrap t UCL	544.7
95% H-UCL (Log ROS)	816		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.529	KM Geo Mean	34.1
KM SD (logged)	1.358	95% Critical H Value (KM-Log)	3.726
KM Standard Error of Mean (logged)	0.434	95% H-UCL (KM -Log)	424.8
KM SD (logged)	1.358	95% Critical H Value (KM-Log)	3.726
KM Standard Error of Mean (logged)	0.434		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	97.08	Mean in Log Scale	3.463
SD in Original Scale	190.7	SD in Log Scale	1.532
95% t UCL (Assumes normality)	201.3	95% H-Stat UCL	753.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	519.7	Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	455.9

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.1

Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	1,1-Dichloroethane	D_1,1-Dichloroethane	1,2,4-Trichlorobenzene	D_1,2,4-Trichlorobenzene	1,2-Dibromo-3-chloropropane (DBCP)	D_1,2-Dibromo-3-chloropropane (DBCP)	1,2-Dichloroethane	D_1,2-Dichloroethane	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzene
OU1	BH1-13	6/13/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH01-18	5/8/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	BH2-13	6/14/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH02-18	5/8/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	BH3-13	6/14/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH03-18	5/7/2018	Upper Aquifer	1.8	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	BH4-13	6/14/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	0.4
OU1	BH04-18	5/8/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	BH5-13	6/14/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH05-18	5/10/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	BH6-13	6/13/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH06-18	5/10/2018	Upper Aquifer	0.3	1	0.27	0	0.0086	0	0.3	0	1.4	1	0.28
OU1	BH7-13	6/12/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH07-18	5/10/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	BH8-13	6/13/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH08-18	5/11/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	BH9-13	6/11/2013	Upper Aquifer	0.27	1	1	0	2	0	1	0	1	0	0.17
OU1	BH09-18	5/14/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	BH10-13	6/11/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH10-18	5/11/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	BH11-13	6/11/2013	Upper Aquifer	0.31	1	1	0	2	0	1	0	1	0	1
OU1	BH12-13	6/11/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH13-13	6/12/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH14-13	6/11/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH14-18	9/17/2018	Upper Aquifer	1.6	1	0.26	0	0.0086	0	0.21	0	0.16	0	0.45
OU1	BH15-13	6/12/2013	Upper Aquifer	0.2	1	1	0	2	0	1	0	1	0	1
OU1	BH16-13	6/12/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH16-13	7/10/2013	Upper Aquifer	2	0	2	0	4	0	2	0	2	0	2
OU1	BH17-13	6/12/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH17-13	7/10/2013	Upper Aquifer	2.9	0	2.9	0	5.7	0	2.9	0	2.9	0	2.9
OU1	BH18-13	6/12/2013	Upper Aquifer	0.22	1	1	0	2	0	1	0	1	0	1
OU1	BH18-13	7/9/2013	Upper Aquifer	0.25	1	1	0	2	0	1	0	1	0	1
OU1	BH19-13	6/13/2013	Upper Aquifer	0.23	1	1	0	2	0	1	0	1	0	1
OU1	BH20-13	6/17/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH20-18	5/15/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.44	1	0.28
OU1	BH21-13	6/17/2013	Upper Aquifer	0.45	1	1	0	2	0	1	0	1	0	1
OU1	BH22-13	6/17/2013	Upper Aquifer	0.24	1	1	0	2	0	1	0	1	0	1
OU1	BH23-13	6/18/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH24-13	6/18/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH25-13	6/18/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH30-13	7/3/2013	Upper Aquifer	1.4	0	1.4	0	2.9	0	1.4	0	1.4	0	0.19
OU1	BH31-13	7/1/2013	Upper Aquifer	2	0	2	0	4	0	2	0	2	0	0.31
OU1	BH32-13	7/2/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH33-13	6/27/2013	Upper Aquifer	5	0	5	0	10	0	2	1	5	0	80
OU1	BH34-13	6/27/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	0.49
OU1	BH35-13	6/28/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH36-13	7/2/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH37-13	7/3/2013	Upper Aquifer	0.44	1	1	0	2	0	1	0	1	0	0.63
OU1	BH38-13	6/28/2013	Upper Aquifer	0.99	1	1	0	2	0	1	0	1	0	0.48
OU1	BH39-13	7/1/2013	Upper Aquifer	0.37	1	1	0	2	0	1	0	1	0	1
OU1	BH40-13	7/2/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH42-13	7/8/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH43-13	7/2/2013	Upper Aquifer	4	1	1	0	2	0	1	0	1	0	0.15
OU1	BH44-13	7/2/2013	Upper Aquifer	0.53	1	1	0	2	0	1	0	1	0	1
OU1	BH46-13	7/2/2013	Upper Aquifer	11	0	11	0	22	0	11	0	11	0	100
OU1	BH46B-13	7/3/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH48B-13	7/8/2013	Upper Aquifer	0.18	1	1	0	2	0	1	0	1	0	0.61
OU1	BH49-13	6/18/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH51-13	6/21/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH52-13	6/19/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH53-13	6/18/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH54-13	6/18/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH55-13	6/18/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH56-13	6/19/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH57-13	6/19/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH58-13	6/19/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1

Table B.20.1

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	1,1-Dichloroethane	D_1,1-Dichloroethane	1,2,4-Trichlorobenzene	D_1,2,4-Trichlorobenzene	1,2-Dibromo-3-chloropropane (DBCP)	D_1,2-Dibromo-3-chloropropane (DBCP)	1,2-Dichloroethane	D_1,2-Dichloroethane	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzene
OU1	BH59-13	6/19/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH60-13	6/19/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH61-13	6/19/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH62-13	6/19/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH63-13	6/20/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH64-13	6/19/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH65-13	6/20/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH66-13	6/26/2013	Upper Aquifer	0.53	1	1	0	2	0	1	0	1	0	1
OU1	BH67-13	6/20/2013	Upper Aquifer	0.55	1	1	0	2	0	1	0	1	0	1
OU1	BH68-13	6/20/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH69-13	6/21/2013	Upper Aquifer	1.7	0	1.7	0	3.3	0	1.7	0	1.7	0	1.7
OU1	BH70-13	6/21/2013	Upper Aquifer	2	0	2	0	4	0	2	0	2	0	2
OU1	BH71-13	6/20/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH72-13	6/20/2013	Upper Aquifer	1	0	1	0	2	0	1	0	2.5	1	0.79
OU1	BH73-13	6/20/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH74-13	6/20/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH75-13	6/25/2013	Upper Aquifer	1	0	1	0	2	0	1	0	0.28	1	0.49
OU1	BH76-13	6/26/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	0.89
OU1	BH77-13	6/25/2013	Upper Aquifer	1.4	0	1.4	0	2.9	0	1.4	0	5.6	1	12
OU1	BH78-13	6/25/2013	Upper Aquifer	0.62	1	1	0	2	0	1	0	0.2	1	0.2
OU1	BH79-13	6/26/2013	Upper Aquifer	0.25	1	1	0	2	0	1	0	0.5	1	0.25
OU1	BH80-13	6/25/2013	Upper Aquifer	0.33	1	1	0	2	0	1	0	1	1	0.23
OU1	BH81-13	6/27/2013	Upper Aquifer	0.41	1	1	0	2	0	1	0	0.27	1	0.33
OU1	BH82-13	6/25/2013	Upper Aquifer	0.47	1	1	0	2	0	1	0	1	0	1
OU1	BH83-13	6/25/2013	Upper Aquifer	1	0	1	0	2	0	1	0	0.43	1	0.31
OU1	BH84-13	6/26/2013	Upper Aquifer	1.7	1	1	0	2	0	1	0	1	0	0.37
OU1	BH85-13	6/25/2013	Upper Aquifer	0.35	1	1	0	2	0	1	0	0.48	1	1
OU1	BH86-13	6/24/2013	Upper Aquifer	2.2	0	2.2	0	4.4	0	2.2	0	2.2	0	0.3
OU1	BH87-13	6/26/2013	Upper Aquifer	0.23	1	1	0	2	0	1	0	1	0	0.29
OU1	BH88-13	6/24/2013	Upper Aquifer	1	0	1.2	1	2	0	1	0	1	0	0.67
OU1	BH89-13	6/24/2013	Upper Aquifer	0.62	1	1	0	2	0	1	0	1	0	0.21
OU1	BH90-13	7/9/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH91-13	6/28/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	BH92-13	7/9/2013	Upper Aquifer	5.2	1	1	0	2	0	1	0	1	0	0.55
OU1	BH93-13	7/9/2013	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	0.62
OU1	MW-101A	5/13/2015	Upper Aquifer	0.44	1	1	0	2	0	1	0	1	0	1
OU1	MW-202	5/12/2015	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	MW-203	5/13/2015	Upper Aquifer	0.32	1	1	0	2	0	1	0	1	0	1
OU1	MW-204	5/11/2015	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	MW-208	10/4/2017	Upper Aquifer	0.25	0	0.27	0	0.0084	0	0.3	0	0.23	0	0.28
OU1	MW-209	5/12/2015	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	MW-209	10/17/2018	Upper Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	MW-210	5/15/2015	Upper Aquifer	2.5	0	2.5	0	5	0	2.5	0	2.5	0	2.5
OU1	MW-210	10/3/2017	Upper Aquifer	0.5	0	0.54	0	0.0084	0	0.6	0	0.46	0	0.56
OU1	MW-210	10/6/2017	Upper Aquifer											
OU1	MW-212	5/12/2015	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	MW-212	10/17/2018	Upper Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	MW-215A	5/13/2015	Upper Aquifer	1	0	1	0	2	0	1	0	0.37	1	2.8
OU1	MW-217	10/17/2018	Upper Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	MW-219	5/13/2015	Upper Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	MW-225	10/5/2017	Upper Aquifer	0.25	0	0.27	0	0.0084	0	0.3	0	0.23	0	0.28
OU1	MW-227	10/4/2017	Upper Aquifer	0.25	0	0.27	0	0.0096	1	0.3	0	0.23	0	0.28
OU1	MW-229	5/14/2015	Upper Aquifer	2.5	0	2.5	0	5	0	2.5	0	2.5	0	2.5
OU1	MW-230	10/17/2018	Upper Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	1	4.4
OU1	MW-233	10/18/2018	Upper Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	MW-235	10/18/2018	Upper Aquifer	11	0	17	0	0.0086	0	14	0	11	0	8.7
OU1	VAS-31	1/19/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-31	1/19/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-31	1/22/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-31	1/22/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-32	1/8/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.63
OU1	VAS-32	1/8/2018	Upper Aquifer	2.5	0	2.7	0	0.0086	0	3	0	2.3	0	2.8
OU1	VAS-32	1/8/2018	Upper Aquifer	8.3	0	9	0	0.0086	0	10	0	7.7	0	9.3
OU1	VAS-32	1/8/2018	Upper Aquifer	1.3	0	1.4	0	0.0086	0	1.5	0	1.2	0	1.4
OU1	VAS-33	1/10/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.45	1	0.28
OU1	VAS-33	1/10/2018	Upper Aquifer	0.3	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.32

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	1,1-Dichloroethane	D_1,1-Dichloroethane	1,2,4-Trichlorobenzene	D_1,2,4-Trichlorobenzene	1,2-Dibromo-3-chloropropane (DBCP)	D_1,2-Dibromo-3-chloropropane (DBCP)	1,2-Dichloroethane	D_1,2-Dichloroethane	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzene
OU1	VAS-33	1/10/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-33	1/10/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-33	1/11/2018	Upper Aquifer	0.28	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-33	1/11/2018	Upper Aquifer	0.36	0	0.39	0	0.0086	0	0.43	0	0.33	0	0.4
OU1	VAS-34	2/16/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-34	2/16/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-34	2/19/2018	Upper Aquifer	0.63	0	0.68	0	0.0086	0	0.75	0	0.58	0	0.71
OU1	VAS-34	2/19/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-34	2/20/2018	Upper Aquifer	0.28	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-37	9/18/2018	Upper Aquifer	1.5	1	1	0	0.0086	0	0.84	0	0.64	0	1.1
OU1	VAS-38	2/7/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-38	2/7/2018	Upper Aquifer	0.48	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-38	2/7/2018	Upper Aquifer	2	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-38	2/7/2018	Upper Aquifer	0.72	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-38	2/8/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-38	2/8/2018	Upper Aquifer	13	1	6.8	0	0.0086	0	7.5	0	5.8	0	7
OU1	VAS-38	2/8/2018	Upper Aquifer	23	1	11	0	0.0086	0	12	0	9.2	0	11
OU1	VAS-38	2/9/2018	Upper Aquifer	1.1	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	1/25/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.47
OU1	VAS-44	1/26/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.83
OU1	VAS-44	1/29/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	1/29/2018	Upper Aquifer	6.3	0	6.8	0	0.0086	0	7.5	0	5.8	0	7
OU1	VAS-44	1/29/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.98
OU1	VAS-44	1/30/2018	Upper Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.49
OU1	MW-209A	5/13/2015	Lower Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	MW-209A	10/17/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	MW-210A	5/15/2015	Lower Aquifer	1	0	1	0	2	0	1	0	1	0	1
OU1	MW-210A	10/3/2017	Lower Aquifer	0.25	0	0.27	0	0.0084	0	0.3	0	0.23	0	0.28
OU1	MW-210B	5/15/2015	Lower Aquifer	14	0	14	0	29	0	14	0	14	0	390
OU1	MW-210B	10/3/2017	Lower Aquifer	0.25	0	0.27	0	0.0084	0	0.3	0	0.23	0	4
OU1	MW-215B	5/13/2015	Lower Aquifer	1.2	1	1.7	0	3.3	0	1.7	0	1.7	0	1.7
OU1	MW-216	5/14/2015	Lower Aquifer	17	0	17	0	33	0	17	0	17	0	17
OU1	VAS-15B	12/13/2017	Lower Aquifer	1	1	0.45	0	0.0084	0	0.5	0	0.38	0	0.47
OU1	VAS-15B	12/13/2017	Lower Aquifer	3.6	0	3.9	0	0.0084	0	4.3	0	3.3	0	4
OU1	VAS-15B	12/14/2017	Lower Aquifer	0.25	0	0.27	0	0.0084	0	0.3	0	0.23	0	0.28
OU1	VAS-15B	12/14/2017	Lower Aquifer	0.25	0	0.27	0	0.0084	0	0.3	0	0.23	0	0.28
OU1	VAS-15B	12/15/2017	Lower Aquifer	0.25	0	0.27	0	0.0084	0	0.3	0	0.23	0	0.28
OU1	VAS-22b	9/25/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-22b	9/26/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-22b	9/26/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-22b	9/27/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-22b	9/27/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-22b	9/27/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-22b	10/2/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-22b	10/2/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-22b	10/3/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-31	1/22/2018	Lower Aquifer	0.45	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-31	1/23/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-31	1/23/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-31	1/24/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-32	1/8/2018	Lower Aquifer	0.65	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-32	1/9/2018	Lower Aquifer	0.6	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-32	1/9/2018	Lower Aquifer	0.67	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-32	1/9/2018	Lower Aquifer	0.45	1	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-33	1/11/2018	Lower Aquifer	0.63	0	0.68	0	0.0086	0	0.75	0	0.58	0	0.7
OU1	VAS-33	1/16/2018	Lower Aquifer	0.42	0	0.45	0	0.0086	0	0.5	0	0.38	0	0.52
OU1	VAS-33	1/16/2018	Lower Aquifer	1.3	0	1.4	0	0.0086	0	1.5	0	1.2	0	1.4
OU1	VAS-33	1/17/2018	Lower Aquifer	0.42	0	0.45	0	0.0086	0	0.5	0	0.38	0	0.47
OU1	VAS-34	2/20/2018	Lower Aquifer	0.5	0	0.54	0	0.0086	0	0.6	0	0.46	0	0.56
OU1	VAS-34	2/20/2018	Lower Aquifer	2.5	0	2.7	0	0.0086	0	3	0	2.3	0	2.8
OU1	VAS-34	2/21/2018	Lower Aquifer	1.7	0	1.8	0	0.0086	0	2	0	1.5	0	1.9
OU1	VAS-34	2/21/2018	Lower Aquifer	0.63	0	0.68	0	0.0086	0	0.75	0	0.58	0	0.7
OU1	VAS-34	2/21/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-34	2/22/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-34	2/22/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-34	2/22/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28

Table B.20.1

Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	1,1-Dichloroethane	D_1,1-Dichloroethane	1,2,4-Trichlorobenzene	D_1,2,4-Trichlorobenzene	1,2-Dibromo-3-chloropropane (DBCP)	D_1,2-Dibromo-3-chloropropane (DBCP)	1,2-Dichloroethane	D_1,2-Dichloroethane	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzene
OU1	VAS-34	2/23/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-37	9/19/2018	Lower Aquifer	0.17	1	0.26	0	0.0086	0	1.2	1	0.16	0	0.13
OU1	VAS-37	9/19/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-37	9/19/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.21
OU1	VAS-37	9/20/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-37	9/20/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-37	9/21/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.42
OU1	VAS-37	9/24/2018	Lower Aquifer	0.17	0	0.26	0	0.0086	0	0.21	0	0.16	0	0.13
OU1	VAS-37	9/24/2018	Lower Aquifer	0.74	1	0.26	0	0.0086	0	0.21	0	0.16	0	0.25
OU1	VAS-38	2/13/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-38	2/13/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-38	2/14/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	1/30/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	1/31/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	1/31/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	2/1/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	2/1/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	2/5/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	2/5/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28
OU1	VAS-44	2/6/2018	Lower Aquifer	0.25	0	0.27	0	0.0086	0	0.3	0	0.23	0	0.28

Table B.20.1

Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				11	12	13	14	15	16	17	18	19	20	21	22
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Benzene	Bromodichloromethane	D_Bromodichloromethane	Chlorobenzene	D_Chlorobenzene	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	cis-1,2-Dichloroethene	D_cis-1,2-Dichloroethene	Ethylbenzene	D_Ethylbenzene	Methylene chloride
OU1	BH1-13	6/13/2013	Upper Aquifer	0	1	0	1	0	1	0	0.45	1	1	0	1
OU1	BH01-18	5/8/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	BH2-13	6/14/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH02-18	5/8/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	BH3-13	6/14/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH03-18	5/7/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	1.7	1	0.26	0	0.53
OU1	BH4-13	6/14/2013	Upper Aquifer	1	1	0	1	0	1.3	1	1	0	1.2	1	1
OU1	BH04-18	5/8/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	BH5-13	6/14/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH05-18	5/10/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.93	1	0.26	0	0.53
OU1	BH6-13	6/13/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH06-18	5/10/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	1.4	1	0.26	0	0.53
OU1	BH7-13	6/12/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH07-18	5/10/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	BH8-13	6/13/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH08-18	5/11/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	4.1	1	0.26	0	0.53
OU1	BH9-13	6/11/2013	Upper Aquifer	1	1	0	1	0	1	0	0.37	1	1	0	1
OU1	BH09-18	5/14/2018	Upper Aquifer	1	0.3	0	2.9	1	0.31	0	2.1	1	0.26	0	0.53
OU1	BH10-13	6/11/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH10-18	5/11/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	1.2	1	0.26	0	0.53
OU1	BH11-13	6/11/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH12-13	6/11/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH13-13	6/12/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH14-13	6/11/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH14-18	9/17/2018	Upper Aquifer	1	0.17	0	2.9	1	0.13	0	5.9	1	0.4	1	2.6
OU1	BH15-13	6/12/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH16-13	6/12/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH16-13	7/10/2013	Upper Aquifer	0	2	0	2	0	2	0	15	1	2	0	2
OU1	BH17-13	6/12/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH17-13	7/10/2013	Upper Aquifer	0	2.9	0	2.9	0	2.9	0	27	1	2.9	0	2.9
OU1	BH18-13	6/12/2013	Upper Aquifer	0	1	0	1	0	1	0	3.1	1	1	0	1
OU1	BH18-13	7/9/2013	Upper Aquifer	0	1	0	1	0	1	0	4.4	1	1	0	1
OU1	BH19-13	6/13/2013	Upper Aquifer	0	1	0	1	0	1	0	3.5	1	1	0	1
OU1	BH20-13	6/17/2013	Upper Aquifer	0	1	0	1	0	1	0	1	1	1	0	1
OU1	BH20-18	5/15/2018	Upper Aquifer	0	0.3	0	18	1	0.31	0	0.99	1	0.26	0	0.53
OU1	BH21-13	6/17/2013	Upper Aquifer	0	1	0	1	0	1	0	0.52	1	1	0	1
OU1	BH22-13	6/17/2013	Upper Aquifer	0	1	0	1	0	1	0	1.1	1	1	0	1
OU1	BH23-13	6/18/2013	Upper Aquifer	0	1	0	1	0	1	0	0.37	1	1	0	1
OU1	BH24-13	6/18/2013	Upper Aquifer	0	1	0	1	0	1	0	0.46	1	1	0	1
OU1	BH25-13	6/18/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH30-13	7/3/2013	Upper Aquifer	1	1.4	0	1.4	0	1.4	0	1.6	1	1.4	0	1.4
OU1	BH31-13	7/1/2013	Upper Aquifer	1	2	0	2	0	2	0	49	1	2	0	2
OU1	BH32-13	7/2/2013	Upper Aquifer	0	1	0	1	0	1	0	0.94	1	1	0	1
OU1	BH33-13	6/27/2013	Upper Aquifer	1	5	0	5	0	5	0	3.8	1	100	1	5
OU1	BH34-13	6/27/2013	Upper Aquifer	1	1	0	0.62	1	1	0	1.7	1	1	0	1
OU1	BH35-13	6/28/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH36-13	7/2/2013	Upper Aquifer	0	1	0	1	0	1	0	1.6	1	1	0	1
OU1	BH37-13	7/3/2013	Upper Aquifer	1	1	0	0.61	1	1	0	4.7	1	1	0	1
OU1	BH38-13	6/28/2013	Upper Aquifer	1	1	0	0.59	1	1	0	2.6	1	0.46	1	1
OU1	BH39-13	7/1/2013	Upper Aquifer	0	1	0	1	0	1	0	6.6	1	1	0	1
OU1	BH40-13	7/2/2013	Upper Aquifer	0	1	0	1	0	1	0	2	1	1	0	1
OU1	BH42-13	7/8/2013	Upper Aquifer	0	1	0	0.44	1	1	0	1	0	1	0	1
OU1	BH43-13	7/2/2013	Upper Aquifer	1	1	0	1	0	1	0	27	1	1	0	1
OU1	BH44-13	7/2/2013	Upper Aquifer	0	1	0	1	0	1	0	1.7	1	1	0	1
OU1	BH46-13	7/2/2013	Upper Aquifer	1	11	0	6.3	1	11	0	2.8	1	9.9	1	11
OU1	BH46B-13	7/3/2013	Upper Aquifer	0	1	0	0.41	1	1	0	1	0	1	0	1
OU1	BH48B-13	7/8/2013	Upper Aquifer	1	1	0	1.7	1	1	0	2.5	1	1	0	1
OU1	BH49-13	6/18/2013	Upper Aquifer	0	1	0	1	0	1	0	0.33	1	1	0	1
OU1	BH51-13	6/21/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	0.84	1	1
OU1	BH52-13	6/19/2013	Upper Aquifer	0	1	0	1	0	1	0	5.6	1	1	0	1
OU1	BH53-13	6/18/2013	Upper Aquifer	0	1	0	1	0	1	0	0.52	1	1	0	1
OU1	BH54-13	6/18/2013	Upper Aquifer	0	1	0	1	0	1	0	0.17	1	1	0	1
OU1	BH55-13	6/18/2013	Upper Aquifer	0	1	0	1	0	1	0	2.5	1	1	0	1
OU1	BH56-13	6/19/2013	Upper Aquifer	0	1	0	1	0	1	0	0.96	1	1	0	1
OU1	BH57-13	6/19/2013	Upper Aquifer	0	1	0	1	0	1	0	4.1	1	1	0	1
OU1	BH58-13	6/19/2013	Upper Aquifer	0	1	0	1	0	1	0	0.29	1	0.68	1	1

Table B.20.1

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				11	12	13	14	15	16	17	18	19	20	21	22
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Benzene	Bromodichloromethane	D_Bromodichloromethane	Chlorobenzene	D_Chlorobenzene	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	cis-1,2-Dichloroethene	D_cis-1,2-Dichloroethene	Ethylbenzene	D_Ethylbenzene	Methylene chloride
OU1	BH59-13	6/19/2013	Upper Aquifer	0	1	0	1	0	1	0	0.68	1	1	0	1
OU1	BH60-13	6/19/2013	Upper Aquifer	0	1	0	1	0	1	0	0.81	1	1	0	1
OU1	BH61-13	6/19/2013	Upper Aquifer	0	1	0	1	0	1	0	0.73	1	1	0	1
OU1	BH62-13	6/19/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	0.86	1	1
OU1	BH63-13	6/20/2013	Upper Aquifer	0	1	0	1	0	1	0	0.9	1	1	0	1
OU1	BH64-13	6/19/2013	Upper Aquifer	0	1	0	1	0	1	0	0.88	1	1	0	1
OU1	BH65-13	6/20/2013	Upper Aquifer	0	1	0	1	0	1	0	1.8	1	1	0	1
OU1	BH66-13	6/26/2013	Upper Aquifer	0	1	0	0.2	1	1	0	2	1	0.39	1	1
OU1	BH67-13	6/20/2013	Upper Aquifer	0	1	0	0.48	1	1	0	1	1	0.67	1	1
OU1	BH68-13	6/20/2013	Upper Aquifer	0	1	0	0.88	1	1	0	1.4	1	1	0	1
OU1	BH69-13	6/21/2013	Upper Aquifer	0	1.7	0	0.85	1	0.48	1	25	1	1.7	0	1.7
OU1	BH70-13	6/21/2013	Upper Aquifer	0	2	0	2	0	0.57	1	0.72	1	2	0	2
OU1	BH71-13	6/20/2013	Upper Aquifer	0	1	0	0.35	1	1	0	2	1	1	0	1
OU1	BH72-13	6/20/2013	Upper Aquifer	1	1	0	7.2	1	1	0	0.44	1	1	0	1
OU1	BH73-13	6/20/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH74-13	6/20/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	0.59	1	1
OU1	BH75-13	6/25/2013	Upper Aquifer	1	1	0	4.5	1	1	0	0.65	1	1	0	1
OU1	BH76-13	6/26/2013	Upper Aquifer	1	1	0	0.47	1	1	0	1	0	1	0	1
OU1	BH77-13	6/25/2013	Upper Aquifer	1	1.4	0	40	1	1.4	0	0.74	1	2.2	1	1.4
OU1	BH78-13	6/25/2013	Upper Aquifer	1	1	0	0.44	1	1	0	1.7	1	0.27	1	1
OU1	BH79-13	6/26/2013	Upper Aquifer	1	1	0	5.7	1	1	0	1.7	1	1	0	1
OU1	BH80-13	6/25/2013	Upper Aquifer	1	1	0	3.4	1	1	0	0.72	1	1	0	1
OU1	BH81-13	6/27/2013	Upper Aquifer	1	1	0	2.8	1	1	0	1.1	1	1	0	1
OU1	BH82-13	6/25/2013	Upper Aquifer	0	1	0	0.21	1	1	0	1	0	1	0	1
OU1	BH83-13	6/25/2013	Upper Aquifer	1	1	0	8.8	1	1	0	2.1	1	1	0	1
OU1	BH84-13	6/26/2013	Upper Aquifer	1	1	0	3.5	1	1	0	2.6	1	1	0	1
OU1	BH85-13	6/25/2013	Upper Aquifer	0	1	0	1.2	1	1	0	1	0	1	0	1
OU1	BH86-13	6/24/2013	Upper Aquifer	1	2.2	0	7.2	1	2.2	0	9.4	1	2.2	0	2.2
OU1	BH87-13	6/26/2013	Upper Aquifer	1	1	0	1	0	1	0	1	0	1	0	1
OU1	BH88-13	6/24/2013	Upper Aquifer	1	1	0	2.9	1	1	0	0.33	1	1	0	1
OU1	BH89-13	6/24/2013	Upper Aquifer	1	1	0	1.4	1	1	0	17	1	1	0	1
OU1	BH90-13	7/9/2013	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	BH91-13	6/28/2013	Upper Aquifer	0	1	0	0.48	1	1	0	1	0	1	0	1
OU1	BH92-13	7/9/2013	Upper Aquifer	1	1	0	5.7	1	1	0	1	0	0.39	1	1
OU1	BH93-13	7/9/2013	Upper Aquifer	1	1	0	1	0	1	0	1	0	1	0	1
OU1	MW-101A	5/13/2015	Upper Aquifer	0	1	0	1	0	1	0	1.8	1	1	0	1
OU1	MW-202	5/12/2015	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	MW-203	5/13/2015	Upper Aquifer	0	1	0	1.4	1	1	0	5	1	1	0	1
OU1	MW-204	5/11/2015	Upper Aquifer	0	1	0	0.31	1	1	0	1	0	1	0	1
OU1	MW-208	10/4/2017	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.67	1	0.26	0	0.53
OU1	MW-209	5/12/2015	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	MW-209	10/17/2018	Upper Aquifer	0	0.17	0	0.14	0	0.13	0	0.16	0	0.11	0	2.6
OU1	MW-210	5/15/2015	Upper Aquifer	0	2.5	0	2.5	0	2.5	0	14	1	2.5	0	2.5
OU1	MW-210	10/3/2017	Upper Aquifer	0	0.6	0	0.64	0	0.62	0	12	1	0.52	0	1.1
OU1	MW-210	10/6/2017	Upper Aquifer												
OU1	MW-212	5/12/2015	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	MW-212	10/17/2018	Upper Aquifer	0	0.17	0	0.14	0	0.13	0	0.16	0	0.11	0	2.6
OU1	MW-215A	5/13/2015	Upper Aquifer	1	1	0	1.7	1	1	0	0.93	1	0.48	1	1
OU1	MW-217	10/17/2018	Upper Aquifer	0	0.17	0	0.14	0	0.13	0	0.16	0	0.11	0	2.6
OU1	MW-219	5/13/2015	Upper Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	MW-225	10/5/2017	Upper Aquifer	0	0.3	0	0.32	0	0.59	1	0.3	0	0.26	0	0.53
OU1	MW-227	10/4/2017	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	2.6	1	0.26	0	0.53
OU1	MW-229	5/14/2015	Upper Aquifer	0	2.5	0	2.5	0	2.5	0	9.8	1	2.5	0	2.5
OU1	MW-230	10/17/2018	Upper Aquifer	1	0.17	0	2.2	1	0.13	0	2	0	0.11	0	2.6
OU1	MW-233	10/18/2018	Upper Aquifer	0	0.17	0	0.14	0	0.13	0	0.36	1	0.11	0	2.6
OU1	MW-235	10/18/2018	Upper Aquifer	0	11	0	9.3	0	8.7	0	1100	1	7.3	0	170
OU1	VAS-31	1/19/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	VAS-31	1/19/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.54	1	0.26	0	0.53
OU1	VAS-31	1/22/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.53	1	0.26	0	0.53
OU1	VAS-31	1/22/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.65	1	0.26	0	0.53
OU1	VAS-32	1/8/2018	Upper Aquifer	1	0.3	0	1.3	1	0.31	0	21	1	0.35	1	0.53
OU1	VAS-32	1/8/2018	Upper Aquifer	0	3	0	3.2	0	3.1	0	58	1	2.6	0	15
OU1	VAS-32	1/8/2018	Upper Aquifer	0	10	0	11	0	10	0	83	1	8.7	0	18
OU1	VAS-32	1/8/2018	Upper Aquifer	0	1.5	0	1.6	0	1.6	0	84	1	1.3	0	2.7
OU1	VAS-33	1/10/2018	Upper Aquifer	0	0.3	0	2.4	1	0.31	0	3.2	1	0.26	0	0.53
OU1	VAS-33	1/10/2018	Upper Aquifer	1	0.3	0	0.77	1	0.31	0	8.8	1	0.26	0	0.53

Table B.20.1

Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				11	12	13	14	15	16	17	18	19	20	21	22
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Benzene	Bromodichloromethane	D_Bromodichloromethane	Chlorobenzene	D_Chlorobenzene	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	cis-1,2-Dichloroethene	D_cis-1,2-Dichloroethene	Ethylbenzene	D_Ethylbenzene	Methylene chloride
OU1	VAS-33	1/10/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	8.6	1	0.26	0	0.53
OU1	VAS-33	1/10/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	11	1	0.26	0	0.53
OU1	VAS-33	1/11/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	12	1	0.26	0	0.53
OU1	VAS-33	1/11/2018	Upper Aquifer	0	0.43	0	0.46	0	0.44	0	45	1	0.37	0	0.76
OU1	VAS-34	2/16/2018	Upper Aquifer	0	0.3	0	0.32	0	0.7	1	1	1	0.26	0	0.53
OU1	VAS-34	2/16/2018	Upper Aquifer	0	0.3	0	0.32	0	0.6	1	5	1	0.26	0	0.53
OU1	VAS-34	2/19/2018	Upper Aquifer	1	0.75	0	0.8	0	0.78	0	27	1	0.65	0	2.3
OU1	VAS-34	2/19/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	4.8	1	0.26	0	0.53
OU1	VAS-34	2/20/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	15	1	0.26	0	0.53
OU1	VAS-37	9/18/2018	Upper Aquifer	1	0.68	0	10	1	0.52	0	0.64	0	4.5	1	10
OU1	VAS-38	2/7/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	VAS-38	2/7/2018	Upper Aquifer	0	0.36	1	0.32	0	0.32	1	0.3	0	0.26	0	0.53
OU1	VAS-38	2/7/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	VAS-38	2/7/2018	Upper Aquifer	0	0.3	0	0.36	1	0.31	0	0.3	0	0.26	0	0.53
OU1	VAS-38	2/8/2018	Upper Aquifer	0	0.3	0	1.5	1	0.31	0	0.3	0	0.26	0	0.53
OU1	VAS-38	2/8/2018	Upper Aquifer	0	7.5	0	8	0	7.8	0	190	1	6.5	0	22
OU1	VAS-38	2/8/2018	Upper Aquifer	0	12	0	13	0	12	0	520	1	10	0	36
OU1	VAS-38	2/9/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	12	1	0.26	0	0.53
OU1	VAS-44	1/25/2018	Upper Aquifer	1	0.3	0	0.32	0	0.31	0	0.89	1	0.26	0	0.53
OU1	VAS-44	1/26/2018	Upper Aquifer	1	0.3	0	0.32	0	0.31	0	3.4	1	0.37	1	0.53
OU1	VAS-44	1/29/2018	Upper Aquifer	0	0.3	0	0.32	0	0.31	0	12	1	0.26	0	0.53
OU1	VAS-44	1/29/2018	Upper Aquifer	0	7.5	0	8	0	7.8	0	220	1	6.5	0	13
OU1	VAS-44	1/29/2018	Upper Aquifer	1	0.34	1	0.32	0	0.39	1	3.5	1	0.26	0	0.53
OU1	VAS-44	1/30/2018	Upper Aquifer	1	0.3	0	0.32	0	0.31	0	1	1	0.26	0	0.53
OU1	MW-209A	5/13/2015	Lower Aquifer	0	1	0	1	0	1	0	1.9	1	1	0	1
OU1	MW-209A	10/17/2018	Lower Aquifer	0	0.17	0	0.14	0	0.13	0	2.6	0	0.11	0	2.6
OU1	MW-210A	5/15/2015	Lower Aquifer	0	1	0	1	0	1	0	1	0	1	0	1
OU1	MW-210A	10/3/2017	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	MW-210B	5/15/2015	Lower Aquifer	1	14	0	14	0	14	0	14	0	14	0	14
OU1	MW-210B	10/3/2017	Lower Aquifer	1	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	MW-215B	5/13/2015	Lower Aquifer	0	1.7	0	1.7	0	1.7	0	35	1	1.7	0	1.7
OU1	MW-216	5/14/2015	Lower Aquifer	0	17	0	17	0	17	0	480	1	17	0	17
OU1	VAS-15B	12/13/2017	Lower Aquifer	0	0.5	0	0.53	0	0.52	0	47	1	0.43	0	2
OU1	VAS-15B	12/13/2017	Lower Aquifer	0	4.3	0	4.6	0	4.4	0	120	1	3.7	0	13
OU1	VAS-15B	12/14/2017	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	16	1	0.26	0	0.53
OU1	VAS-15B	12/14/2017	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	6.8	1	0.26	0	0.53
OU1	VAS-15B	12/15/2017	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	0.78	1	0.26	0	0.53
OU1	VAS-22b	9/25/2018	Lower Aquifer	0	0.5	1	0.14	0	1.3	1	0.16	0	0.11	0	2.6
OU1	VAS-22b	9/26/2018	Lower Aquifer	0	0.17	0	0.14	0	0.59	1	0.16	0	0.11	0	2.6
OU1	VAS-22b	9/26/2018	Lower Aquifer	0	0.17	0	0.14	0	0.26	1	0.16	0	0.11	0	2.6
OU1	VAS-22b	9/27/2018	Lower Aquifer	0	0.17	0	0.14	0	0.13	1	0.16	0	0.11	0	2.6
OU1	VAS-22b	9/27/2018	Lower Aquifer	0	0.7	1	0.14	0	1.5	1	0.16	0	0.11	0	2.6
OU1	VAS-22b	9/27/2018	Lower Aquifer	0	0.17	0	0.14	0	0.2	1	0.16	0	0.11	0	2.6
OU1	VAS-22b	10/2/2018	Lower Aquifer	0	0.17	0	0.14	0	0.16	1	0.16	0	0.11	0	2.6
OU1	VAS-22b	10/2/2018	Lower Aquifer	0	0.52	1	0.14	0	1.6	1	0.16	0	0.11	0	2.6
OU1	VAS-22b	10/3/2018	Lower Aquifer	0	0.17	0	0.14	0	0.82	1	0.16	0	0.11	0	2.6
OU1	VAS-31	1/22/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	1.6	1	0.26	0	0.53
OU1	VAS-31	1/23/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	6.1	1	0.26	0	0.53
OU1	VAS-31	1/23/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	5	1	0.26	0	0.53
OU1	VAS-31	1/24/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	4.1	1	0.26	0	0.53
OU1	VAS-32	1/8/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	19	1	0.26	0	0.53
OU1	VAS-32	1/9/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	2.8	1	0.26	0	0.53
OU1	VAS-32	1/9/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	2	1	0.26	0	0.53
OU1	VAS-32	1/9/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	4.8	1	0.26	0	0.53
OU1	VAS-33	1/11/2018	Lower Aquifer	0	0.75	0	0.8	0	0.78	0	9.4	1	0.65	0	1.3
OU1	VAS-33	1/16/2018	Lower Aquifer	1	0.5	0	0.53	0	0.52	0	29	1	0.43	0	4.1
OU1	VAS-33	1/16/2018	Lower Aquifer	0	1.5	0	1.6	0	1.6	0	36	1	1.3	0	12
OU1	VAS-33	1/17/2018	Lower Aquifer	0	0.5	0	0.53	0	0.52	0	39	1	0.43	0	2.4
OU1	VAS-34	2/20/2018	Lower Aquifer	0	0.6	0	0.64	0	0.62	0	53	1	0.52	0	2
OU1	VAS-34	2/20/2018	Lower Aquifer	0	3	0	3.2	0	3.1	0	78	1	2.6	0	9.8
OU1	VAS-34	2/21/2018	Lower Aquifer	0	2	0	2.1	0	2.1	0	71	1	1.7	0	5.8
OU1	VAS-34	2/21/2018	Lower Aquifer	0	0.75	0	0.8	0	0.78	0	48	1	0.65	0	2.4
OU1	VAS-34	2/21/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	21	1	0.26	0	0.53
OU1	VAS-34	2/22/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	2.6	1	0.26	0	0.53
OU1	VAS-34	2/22/2018	Lower Aquifer	0	1.1	1	0.32	0	1.8	1	3	1	0.26	0	0.53
OU1	VAS-34	2/22/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	5.2	1	0.26	0	0.53

Table B.20.1

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				11	12	13	14	15	16	17	18	19	20	21	22
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Benzene	Bromodichloromethane	D_Bromodichloromethane	Chlorobenzene	D_Chlorobenzene	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	cis-1,2-Dichloroethene	D_cis-1,2-Dichloroethene	Ethylbenzene	D_Ethylbenzene	Methylene chloride
OU1	VAS-34	2/23/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	2.1	1	0.26	0	0.53
OU1	VAS-37	9/19/2018	Lower Aquifer	0	0.17	0	0.14	0	0.36	1	0.21	1	0.11	0	2.6
OU1	VAS-37	9/19/2018	Lower Aquifer	0	0.17	0	0.14	0	0.13	0	0.16	0	0.11	0	2.6
OU1	VAS-37	9/19/2018	Lower Aquifer	0	0.17	0	0.14	0	0.24	1	0.41	1	0.11	0	2.6
OU1	VAS-37	9/20/2018	Lower Aquifer	0	0.17	0	0.14	0	0.27	1	11	1	0.11	0	2.6
OU1	VAS-37	9/20/2018	Lower Aquifer	0	0.17	0	0.14	0	0.27	1	13	1	0.11	0	2.6
OU1	VAS-37	9/21/2018	Lower Aquifer	1	0.17	0	0.14	0	0.13	1	17	1	0.11	0	2.6
OU1	VAS-37	9/24/2018	Lower Aquifer	0	0.17	0	0.14	0	0.13	0	9.3	1	0.11	0	2.6
OU1	VAS-37	9/24/2018	Lower Aquifer	1	0.17	0	0.36	1	0.26	1	11	1	0.13	1	2.6
OU1	VAS-38	2/13/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	0.41	1	0.26	0	0.53
OU1	VAS-38	2/13/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	0.62	1	0.26	0	0.53
OU1	VAS-38	2/14/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	2.1	1	0.26	0	0.53
OU1	VAS-44	1/30/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	0.75	1	0.26	0	0.53
OU1	VAS-44	1/31/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	3.1	1	0.26	0	0.53
OU1	VAS-44	1/31/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	1.8	1	0.26	0	0.53
OU1	VAS-44	2/1/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	3.6	1	0.26	0	0.53
OU1	VAS-44	2/1/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	0.63	1	0.26	0	0.53
OU1	VAS-44	2/5/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	VAS-44	2/5/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53
OU1	VAS-44	2/6/2018	Lower Aquifer	0	0.3	0	0.32	0	0.31	0	0.3	0	0.26	0	0.53

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Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				23	24	25	26	27	28	29	30	31	32	33	34
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Methylene chloride	Toluene	D_Toluene	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Xylenes (total)	D_Xylenes (total)	Biphenyl (1,1-Biphenyl)	D_Biphenyl (1,1-Biphenyl)	bis(2-Ethylhexyl)phthalate (DEHP)
OU1	BH1-13	6/13/2013	Upper Aquifer	0	1	0	1.4	1	1	0	2	0			
OU1	BH01-18	5/8/2018	Upper Aquifer	0	0.48	1	0.33	0	0.45	0	0.24	0			
OU1	BH2-13	6/14/2013	Upper Aquifer	0	1	0	0.71	1	1	0	2	0			
OU1	BH02-18	5/8/2018	Upper Aquifer	0	0.27	1	0.52	0	0.45	0	0.24	0			
OU1	BH3-13	6/14/2013	Upper Aquifer	0	0.21	1	0.43	1	1	0	2	0			
OU1	BH03-18	5/7/2018	Upper Aquifer	0	0.23	0	12	1	0.45	0	0.24	0			
OU1	BH4-13	6/14/2013	Upper Aquifer	0	3	1	1.9	1	1	0	4.4	1			
OU1	BH04-18	5/8/2018	Upper Aquifer	0	0.35	1	0.33	0	0.45	0	0.24	0			
OU1	BH5-13	6/14/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH05-18	5/10/2018	Upper Aquifer	0	0.31	1	0.53	1	0.45	0	0.24	0			
OU1	BH6-13	6/13/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH06-18	5/10/2018	Upper Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	BH7-13	6/12/2013	Upper Aquifer	0	0.18	1	1	0	1	0	2	0			
OU1	BH07-18	5/10/2018	Upper Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	BH8-13	6/13/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH08-18	5/11/2018	Upper Aquifer	0	0.23	0	4.1	1	0.45	0	0.24	0	0.13	0	1.7
OU1	BH9-13	6/11/2013	Upper Aquifer	0	0.27	1	1	0	1	0	2	0			
OU1	BH09-18	5/14/2018	Upper Aquifer	0	0.23	0	0.33	0	15	1	0.24	0	0.13	0	1.7
OU1	BH10-13	6/11/2013	Upper Aquifer	0	0.18	1	1	0	1	0	2	0			
OU1	BH10-18	5/11/2018	Upper Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0	0.14	0	1.8
OU1	BH11-13	6/11/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH12-13	6/11/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH13-13	6/12/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH14-13	6/11/2013	Upper Aquifer	0	1	0	0.27	1	1	0	2	0			
OU1	BH14-18	9/17/2018	Upper Aquifer	0	1.3	1	4.3	1	1.9	1	1	1	0.47	0	2.7
OU1	BH15-13	6/12/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH16-13	6/12/2013	Upper Aquifer	0	1	0	0.96	1	1	0	2	0			
OU1	BH16-13	7/10/2013	Upper Aquifer	0	2	0	78	1	2	0	4	0			
OU1	BH17-13	6/12/2013	Upper Aquifer	0	1	0	0.56	1	1	0	2	0			
OU1	BH17-13	7/10/2013	Upper Aquifer	0	2.9	0	94	1	2.9	0	5.7	0			
OU1	BH18-13	6/12/2013	Upper Aquifer	0	1	0	3.4	1	1	0	2	0			
OU1	BH18-13	7/9/2013	Upper Aquifer	0	1	0	8.8	1	1	0	2	0			
OU1	BH19-13	6/13/2013	Upper Aquifer	0	1	0	1.8	1	1	0	2	0			
OU1	BH20-13	6/17/2013	Upper Aquifer	0	1	0	1.8	1	1	0	2	0			
OU1	BH20-18	5/15/2018	Upper Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0	0.47	0	2.1
OU1	BH21-13	6/17/2013	Upper Aquifer	0	0.19	1	1	1	1	0	2	0			
OU1	BH22-13	6/17/2013	Upper Aquifer	0	1	0	0.72	1	1	0	2	0			
OU1	BH23-13	6/18/2013	Upper Aquifer	0	1	0	0.79	1	1	0	2	0			
OU1	BH24-13	6/18/2013	Upper Aquifer	0	1	0	2	1	1	0	2	0			
OU1	BH25-13	6/18/2013	Upper Aquifer	0	0.15	1	1.3	1	1	0	2	0			
OU1	BH30-13	7/3/2013	Upper Aquifer	0	1.4	0	39	1	1.4	0	2.9	0			
OU1	BH31-13	7/1/2013	Upper Aquifer	0	2	0	57	1	9.4	1	4	0			
OU1	BH32-13	7/2/2013	Upper Aquifer	0	0.17	1	1	0	1	0	2	0			
OU1	BH33-13	6/27/2013	Upper Aquifer	0	32	1	5	0	1.1	1	190	1			
OU1	BH34-13	6/27/2013	Upper Aquifer	0	0.34	1	1	0	11	1	2	0			
OU1	BH35-13	6/28/2013	Upper Aquifer	0	1	0	1	0	2.2	1	2	0			
OU1	BH36-13	7/2/2013	Upper Aquifer	0	1	0	1	0	2.3	1	2	0			
OU1	BH37-13	7/3/2013	Upper Aquifer	0	1	0	1	0	7.7	1	2	0			
OU1	BH38-13	6/28/2013	Upper Aquifer	0	11	1	1	0	1.9	1	2.2	1			
OU1	BH39-13	7/1/2013	Upper Aquifer	0	1	0	1	1	3.6	1	2	0			
OU1	BH40-13	7/2/2013	Upper Aquifer	0	1	0	0.56	1	0.25	1	2	0			
OU1	BH42-13	7/8/2013	Upper Aquifer	0	0.18	1	1	0	3.5	1	2	0			
OU1	BH43-13	7/2/2013	Upper Aquifer	0	1	0	6.1	1	6.2	1	2	0			
OU1	BH44-13	7/2/2013	Upper Aquifer	0	0.13	1	1.9	1	0.28	1	2	0			
OU1	BH46-13	7/2/2013	Upper Aquifer	0	270	1	11	0	11	0	36	1			
OU1	BH46B-13	7/3/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH48B-13	7/8/2013	Upper Aquifer	0	0.26	1	1	0	2.9	1	2	0			
OU1	BH49-13	6/18/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH51-13	6/21/2013	Upper Aquifer	0	0.32	1	1	0	1	0	6.3	1			
OU1	BH52-13	6/19/2013	Upper Aquifer	0	1	0	0.4	1	0.73	1	2	0			
OU1	BH53-13	6/18/2013	Upper Aquifer	0	1	0	2	1	1	0	2	0			
OU1	BH54-13	6/18/2013	Upper Aquifer	0	1	0	0.58	1	1	0	2	0			
OU1	BH55-13	6/18/2013	Upper Aquifer	0	1	0	2.1	1	0.46	1	2	0			
OU1	BH56-13	6/19/2013	Upper Aquifer	0	1	0	0.71	1	1	0	2	0			
OU1	BH57-13	6/19/2013	Upper Aquifer	0	1	0	0.95	1	0.48	1	2	0			
OU1	BH58-13	6/19/2013	Upper Aquifer	0	0.34	1	1	0	1	0	4.7	1			

Table B.20.1

Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				23	24	25	26	27	28	29	30	31	32	33	34
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Methylene chloride	Toluene	D_Toluene	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Xylenes (total)	D_Xylenes (total)	Biphenyl (1,1-Biphenyl)	D_Biphenyl (1,1-Biphenyl)	bis(2-Ethylhexyl)phthalate (DEHP)
OU1	BH59-13	6/19/2013	Upper Aquifer	0	0.14	1	1.6	1	1	0	2	0			
OU1	BH60-13	6/19/2013	Upper Aquifer	0	1	0	1.3	1	1	0	2	0			
OU1	BH61-13	6/19/2013	Upper Aquifer	0	1	0	0.8	1	1	0	2	0			
OU1	BH62-13	6/19/2013	Upper Aquifer	0	0.5	1	1	0	1	0	7.3	1			
OU1	BH63-13	6/20/2013	Upper Aquifer	0	0.22	1	0.7	1	1	0	2	0			
OU1	BH64-13	6/19/2013	Upper Aquifer	0	1	0	1.1	1	1	0	2	0			
OU1	BH65-13	6/20/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH66-13	6/26/2013	Upper Aquifer	0	1	0	1	0	0.29	1	0.64	1			
OU1	BH67-13	6/20/2013	Upper Aquifer	0	1	0	1	0	0.57	1	0.3	1			
OU1	BH68-13	6/20/2013	Upper Aquifer	0	0.17	1	1	0	1	0	2	0			
OU1	BH69-13	6/21/2013	Upper Aquifer	0	0.92	1	43	1	1.7	0	3.3	0			
OU1	BH70-13	6/21/2013	Upper Aquifer	0	1.2	1	74	1	2	0	4	0			
OU1	BH71-13	6/20/2013	Upper Aquifer	0	1	0	0.24	1	1	0	2	0			
OU1	BH72-13	6/20/2013	Upper Aquifer	0	0.24	1	0.17	1	1	0	0.53	1			
OU1	BH73-13	6/20/2013	Upper Aquifer	0	1	0	2.6	1	1	0	2	0			
OU1	BH74-13	6/20/2013	Upper Aquifer	0	0.33	1	0.8	1	1	0	4.1	1			
OU1	BH75-13	6/25/2013	Upper Aquifer	0	0.19	1	1	0	0.34	1	2	0			
OU1	BH76-13	6/26/2013	Upper Aquifer	0	0.15	1	1	0	1	0	0.35	1			
OU1	BH77-13	6/25/2013	Upper Aquifer	0	0.5	1	1.4	0	0.32	1	5.7	1			
OU1	BH78-13	6/25/2013	Upper Aquifer	0	0.48	1	0.38	1	0.41	1	0.85	1			
OU1	BH79-13	6/26/2013	Upper Aquifer	0	0.17	1	1	0	5.3	1	2	0			
OU1	BH80-13	6/25/2013	Upper Aquifer	0	0.13	1	1	0	0.41	1	2	0			
OU1	BH81-13	6/27/2013	Upper Aquifer	0	0.23	1	0.17	1	0.44	1	2	0			
OU1	BH82-13	6/25/2013	Upper Aquifer	0	1	0	1	0	1.9	1	2	0			
OU1	BH83-13	6/25/2013	Upper Aquifer	0	0.23	1	1	0	2.2	1	2	0			
OU1	BH84-13	6/26/2013	Upper Aquifer	0	0.15	1	0.54	1	0.31	1	2	0			
OU1	BH85-13	6/25/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH86-13	6/24/2013	Upper Aquifer	0	2.2	0	2.2	0	54	1	4.4	0			
OU1	BH87-13	6/26/2013	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	BH88-13	6/24/2013	Upper Aquifer	0	0.49	1	1	0	2.5	1	2	0			
OU1	BH89-13	6/24/2013	Upper Aquifer	0	0.18	1	11	1	7	1	2	0			
OU1	BH90-13	7/9/2013	Upper Aquifer	0	0.16	1	1	0	1	0	2	0			
OU1	BH91-13	6/28/2013	Upper Aquifer	0	0.14	1	1	0	1	0	2	0			
OU1	BH92-13	7/9/2013	Upper Aquifer	0	0.38	1	1	0	1	0	0.75	1			
OU1	BH93-13	7/9/2013	Upper Aquifer	0	0.41	1	1	0	1	0	2	0			
OU1	MW-101A	5/13/2015	Upper Aquifer	0	1	0	1	0	1.7	1	2	0			
OU1	MW-202	5/12/2015	Upper Aquifer	0	1	0	2.3	1	1	0	2	0			
OU1	MW-203	5/13/2015	Upper Aquifer	0	1	0	1.1	1	1.6	1	2	0			
OU1	MW-204	5/11/2015	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	MW-208	10/4/2017	Upper Aquifer	0	0.23	0	1.4	1	0.45	0	0.24	0	0.13	0	1.7
OU1	MW-209	5/12/2015	Upper Aquifer	0	1	0	1	0	1	1	2	0			
OU1	MW-209	10/17/2018	Upper Aquifer	0	0.14	0	0.1	0	0.2	0	0.15	0	0.47	0	2.1
OU1	MW-210	5/15/2015	Upper Aquifer	0	2.5	0	78	1	2.5	0	5	0			
OU1	MW-210	10/3/2017	Upper Aquifer	0	0.46	0	47	1	0.9	0	0.48	0	0.13	0	1.7
OU1	MW-210	10/6/2017	Upper Aquifer												
OU1	MW-212	5/12/2015	Upper Aquifer	0	1	0	1	0	1	0	2	0			
OU1	MW-212	10/17/2018	Upper Aquifer	0	0.14	0	0.1	0	0.2	0	0.15	0	0.47	0	2.1
OU1	MW-215A	5/13/2015	Upper Aquifer	0	1	0	1	0	0.31	1	2	0			
OU1	MW-217	10/17/2018	Upper Aquifer	0	0.14	0	0.1	0	0.2	0	0.15	0	0.48	0	28
OU1	MW-219	5/13/2015	Upper Aquifer	0	0.25	1	1	0	1	0	2	0			
OU1	MW-225	10/5/2017	Upper Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0	0.12	0	1.6
OU1	MW-227	10/4/2017	Upper Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0	0.13	0	1.7
OU1	MW-229	5/14/2015	Upper Aquifer	0	2.5	0	85	1	2.5	0	5	0			
OU1	MW-230	10/17/2018	Upper Aquifer	0	0.14	0	0.1	0	0.2	0	0.4	1	0.49	0	2.2
OU1	MW-233	10/18/2018	Upper Aquifer	0	0.14	0	1.9	1	0.2	0	0.15	0	0.47	0	2.1
OU1	MW-235	10/18/2018	Upper Aquifer	0	9.3	0	6.7	0	620	1	10	0	0.47	0	2.1
OU1	VAS-31	1/19/2018	Upper Aquifer	0	0.43	1	0.33	0	0.45	0	0.24	0	0.88	0	1.6
OU1	VAS-31	1/19/2018	Upper Aquifer	0	1.4	1	8.3	1	0.45	0	0.24	0			
OU1	VAS-31	1/22/2018	Upper Aquifer	0	0.23	0	3	1	0.45	0	0.24	0			
OU1	VAS-31	1/22/2018	Upper Aquifer	0	0.23	0	2.8	1	0.45	0	0.24	0	0.41	1	1.7
OU1	VAS-32	1/8/2018	Upper Aquifer	0	0.65	1	0.33	0	4	1	1.4	1	0.13	0	1.6
OU1	VAS-32	1/8/2018	Upper Aquifer	1	2.3	0	3.3	0	75	1	2.4	0			
OU1	VAS-32	1/8/2018	Upper Aquifer	0	7.7	0	11	0	400	1	8	0			
OU1	VAS-32	1/8/2018	Upper Aquifer	0	1.2	0	1.7	0	11	1	1.2	0	0.13	0	3
OU1	VAS-33	1/10/2018	Upper Aquifer	0	0.23	0	0.33	0	1.6	1	0.24	0	0.13	0	1.7
OU1	VAS-33	1/10/2018	Upper Aquifer	0	0.25	1	0.48	1	15	1	0.24	0			

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				23	24	25	26	27	28	29	30	31	32	33	34
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Methylene chloride	Toluene	D_Toluene	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Xylenes (total)	D_Xylenes (total)	Biphenyl (1,1-Biphenyl)	D_Biphenyl (1,1-Biphenyl)	bis(2-Ethylhexyl)phthalate (DEHP)
OU1	VAS-33	1/10/2018	Upper Aquifer	0	0.23	0	0.33	0	9.5	1	0.24	0			
OU1	VAS-33	1/10/2018	Upper Aquifer	0	0.23	0	0.38	1	4.5	1	0.24	0			
OU1	VAS-33	1/11/2018	Upper Aquifer	0	0.23	0	0.33	0	6.3	1	0.24	0	0.13	0	1.7
OU1	VAS-33	1/11/2018	Upper Aquifer	0	0.33	0	0.47	0	6.8	1	0.34	0			
OU1	VAS-34	2/16/2018	Upper Aquifer	0	0.23	0	7	1	0.45	0	0.24	0	0.12	0	1.6
OU1	VAS-34	2/16/2018	Upper Aquifer	0	0.85	1	18	1	0.45	0	0.24	0			
OU1	VAS-34	2/19/2018	Upper Aquifer	0	3.9	1	57	1	1.1	0	0.6	0			
OU1	VAS-34	2/19/2018	Upper Aquifer	0	0.42	1	21	1	0.45	0	0.24	0	0.12	0	1.6
OU1	VAS-34	2/20/2018	Upper Aquifer	0	0.23	0	7.1	1	0.45	0	0.24	0			
OU1	VAS-37	9/18/2018	Upper Aquifer	0	82	1	2.4	1	0.8	0	19	1	2.4	0	160
OU1	VAS-38	2/7/2018	Upper Aquifer	0	0.5	1	0.33	0	0.45	0	0.24	0	0.13	0	1.7
OU1	VAS-38	2/7/2018	Upper Aquifer	0	1.1	1	0.33	0	0.45	0	0.24	0			
OU1	VAS-38	2/7/2018	Upper Aquifer	0	0.83	1	0.33	0	0.45	0	0.24	0			
OU1	VAS-38	2/7/2018	Upper Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	VAS-38	2/8/2018	Upper Aquifer	0	0.32	1	0.33	0	0.45	0	0.24	0			
OU1	VAS-38	2/8/2018	Upper Aquifer	0	5.8	0	8.3	0	230	1	6	0			
OU1	VAS-38	2/8/2018	Upper Aquifer	0	9.2	0	13	0	270	1	9.6	0			
OU1	VAS-38	2/9/2018	Upper Aquifer	0	0.23	0	0.33	0	20	1	0.24	0	0.13	0	1.7
OU1	VAS-44	1/25/2018	Upper Aquifer	0	1.9	1	0.35	1	0.45	0	0.26	1			
OU1	VAS-44	1/26/2018	Upper Aquifer	0	4.1	1	0.33	0	0.45	0	0.49	1			
OU1	VAS-44	1/29/2018	Upper Aquifer	0	0.43	1	0.33	0	2.5	1	0.24	0			
OU1	VAS-44	1/29/2018	Upper Aquifer	0	5.8	0	8.3	0	250	1	6	0			
OU1	VAS-44	1/29/2018	Upper Aquifer	0	0.23	0	0.33	0	2.9	1	0.24	0			
OU1	VAS-44	1/30/2018	Upper Aquifer	0	0.23	0	0.33	0	6.8	1	0.24	0			
OU1	MW-209A	5/13/2015	Lower Aquifer	0	1	0	1	0	9.3	1	2	0			
OU1	MW-209A	10/17/2018	Lower Aquifer	0	0.14	0	0.1	0	3.8	1	0.15	0	0.49	0	2.2
OU1	MW-210A	5/15/2015	Lower Aquifer	0	1	0	1	0	32	1	2	0			
OU1	MW-210A	10/3/2017	Lower Aquifer	0	0.23	0	0.33	0	24	1	0.24	0	0.14	0	1.8
OU1	MW-210B	5/15/2015	Lower Aquifer	0	14	0	14	0	14	0	29	0			
OU1	MW-210B	10/3/2017	Lower Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0	0.13	0	1.6
OU1	MW-215B	5/13/2015	Lower Aquifer	0	1.7	0	1.7	0	5.4	1	3.3	0			
OU1	MW-216	5/14/2015	Lower Aquifer	0	17	0	17	0	350	1	33	0			
OU1	VAS-15B	12/13/2017	Lower Aquifer		0.38	0	0.55	0	31	1	0.4	0			
OU1	VAS-15B	12/13/2017	Lower Aquifer	0	3.3	0	4.7	0	70	1	3.4	0			
OU1	VAS-15B	12/14/2017	Lower Aquifer	0	0.23	0	0.33	0	27	1	0.24	0			
OU1	VAS-15B	12/14/2017	Lower Aquifer	0	0.23	0	0.33	0	27	1	0.24	0			
OU1	VAS-15B	12/15/2017	Lower Aquifer	0	0.23	0	0.33	0	15	1	0.24	0			
OU1	VAS-22b	9/25/2018	Lower Aquifer	0	1.6	1	0.1	0	6.3	1	0.15	0			
OU1	VAS-22b	9/26/2018	Lower Aquifer	0	2.7	1	0.1	0	3.4	1	0.15	0			
OU1	VAS-22b	9/26/2018	Lower Aquifer	0	0.14	0	0.1	0	4.1	1	0.15	0			
OU1	VAS-22b	9/27/2018	Lower Aquifer	0	0.83	1	0.1	0	3.2	1	0.15	0			
OU1	VAS-22b	9/27/2018	Lower Aquifer	0	1.8	1	0.1	0	8.1	1	0.15	0			
OU1	VAS-22b	9/27/2018	Lower Aquifer	0	0.23	1	0.1	0	2	1	0.15	0			
OU1	VAS-22b	10/2/2018	Lower Aquifer	0	0.54	1	0.1	0	4	1	0.21	0			
OU1	VAS-22b	10/2/2018	Lower Aquifer	0	2	1	0.1	0	6.5	1	0.2	0			
OU1	VAS-22b	10/3/2018	Lower Aquifer	0	0.49	1	0.1	0	5.5	1	0.15	0			
OU1	VAS-31	1/22/2018	Lower Aquifer	0	0.23	0	0.42	1	0.45	0	0.24	0			
OU1	VAS-31	1/23/2018	Lower Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	VAS-31	1/23/2018	Lower Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	VAS-31	1/24/2018	Lower Aquifer	0	0.38	1	0.33	0	0.45	0	0.24	0			
OU1	VAS-32	1/8/2018	Lower Aquifer	0	0.61	1	5.8	1	10	1	0.41	0			
OU1	VAS-32	1/9/2018	Lower Aquifer	0	0.23	0	5.2	1	2	1	0.24	0			
OU1	VAS-32	1/9/2018	Lower Aquifer	0	0.26	1	6.9	1	0.63	1	0.24	0			
OU1	VAS-32	1/9/2018	Lower Aquifer	0	0.27	1	4.5	1	0.45	0	0.24	0			
OU1	VAS-33	1/11/2018	Lower Aquifer	0	0.58	0	0.83	0	29	1	0.6	0			
OU1	VAS-33	1/16/2018	Lower Aquifer	0	0.38	0	0.55	0	50	1	0.4	0			
OU1	VAS-33	1/16/2018	Lower Aquifer	0	1.2	0	1.7	0	44	1	1.2	0			
OU1	VAS-33	1/17/2018	Lower Aquifer	0	0.38	0	0.55	0	49	1	0.4	0			
OU1	VAS-34	2/20/2018	Lower Aquifer	1	0.46	0	0.72	1	2.3	1	0.48	0			
OU1	VAS-34	2/20/2018	Lower Aquifer	1	2.3	0	3.3	0	110	1	2.4	0			
OU1	VAS-34	2/21/2018	Lower Aquifer	0	1.5	0	2.2	0	64	1	1.6	0			
OU1	VAS-34	2/21/2018	Lower Aquifer	0	0.69	1	4.1	1	39	1	0.6	0			
OU1	VAS-34	2/21/2018	Lower Aquifer	0	0.53	1	0.9	1	17	1	0.15	0			
OU1	VAS-34	2/22/2018	Lower Aquifer	0	0.23	0	0.33	0	2.8	1	0.24	0			
OU1	VAS-34	2/22/2018	Lower Aquifer	0	0.24	1	0.33	0	3.6	1	0.24	0			
OU1	VAS-34	2/22/2018	Lower Aquifer	0	0.23	1	0.33	0	4.1	1	0.24	0			

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Moraine, Ohio

				23	24	25	26	27	28	29	30	31	32	33	34
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Methylene chloride	Toluene	D_Toluene	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Xylenes (total)	D_Xylenes (total)	Biphenyl (1,1-Biphenyl)	D_Biphenyl (1,1-Biphenyl)	bis(2-Ethylhexyl)phthalate (DEHP)
OU1	VAS-34	2/23/2018	Lower Aquifer	0	0.23	0	0.33	0	2.4	1	0.24	0			
OU1	VAS-37	9/19/2018	Lower Aquifer	0	1.6	1	0.1	0	0.55	1	0.15	0			
OU1	VAS-37	9/19/2018	Lower Aquifer	0	0.14	0	0.1	0	0.2	0	0.15	0			
OU1	VAS-37	9/19/2018	Lower Aquifer	0	1.8	1	0.1	0	2.6	1	0.15	0	0.47	0	2.1
OU1	VAS-37	9/20/2018	Lower Aquifer	0	1.5	1	0.1	0	2.8	1	0.15	0			
OU1	VAS-37	9/20/2018	Lower Aquifer	0	8.1	1	0.1	0	2.3	1	0.15	0			
OU1	VAS-37	9/21/2018	Lower Aquifer	0	0.68	1	0.31	0	3.2	1	0.15	0			
OU1	VAS-37	9/24/2018	Lower Aquifer	0	6.6	1	0.1	0	2.5	1	0.15	0			
OU1	VAS-37	9/24/2018	Lower Aquifer	0	5	1	0.1	0	1.7	1	0.18	1			
OU1	VAS-38	2/13/2018	Lower Aquifer	0	0.23	0	0.33	0	0.81	1	0.24	0			
OU1	VAS-38	2/13/2018	Lower Aquifer	0	0.34	1	0.33	0	1.5	1	0.24	0			
OU1	VAS-38	2/14/2018	Lower Aquifer	0	0.23	0	0.33	0	0.52	1	0.24	0			
OU1	VAS-44	1/30/2018	Lower Aquifer	0	0.23	0	0.33	0	2.3	1	0.24	0			
OU1	VAS-44	1/31/2018	Lower Aquifer	0	0.23	0	0.33	0	0.6	1	0.24	0			
OU1	VAS-44	1/31/2018	Lower Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	VAS-44	2/1/2018	Lower Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	VAS-44	2/1/2018	Lower Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	VAS-44	2/5/2018	Lower Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	VAS-44	2/5/2018	Lower Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			
OU1	VAS-44	2/6/2018	Lower Aquifer	0	0.23	0	0.33	0	0.45	0	0.24	0			

Table B.20.1

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South Dayton Dump Site
Moraine, Ohio

				35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_bis(2-Ethylhexyl)phthalate (DEHP)	Naphthalene	D_Naphthalene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Beryllium	Cadmium	D_Cadmium	Chromium	D_Chromium	Cobalt
OU1	BH1-13	6/13/2013	Upper Aquifer		1	0	200	0	10	0	10	0	120	1	5	0	2	0	5	0	7
OU1	BH01-18	5/8/2018	Upper Aquifer				540	1	0.57	0	1.1	1	170	1	0.33	1	0.21	0	1.6	1	1.1
OU1	BH2-13	6/14/2013	Upper Aquifer		1	0	200	0	10	0	10	0	130	1	5	0	2	0	5	0	2.7
OU1	BH02-18	5/8/2018	Upper Aquifer				5700	1	1.8	1	11	1	360	1	0.81	1	0.68	1	18	1	4.4
OU1	BH3-13	6/14/2013	Upper Aquifer		1	0															
OU1	BH03-18	5/7/2018	Upper Aquifer				790	1	1.3	1	0.75	0	250	1	0.35	1	0.31	1	3.2	1	2.4
OU1	BH4-13	6/14/2013	Upper Aquifer		1	0	200	0	10	0	10	0	430	1	5	0	2	0	5	0	7
OU1	BH04-18	5/8/2018	Upper Aquifer				430	1	0.57	0	0.75	0	170	1	0.31	0	0.21	0	1.4	1	1
OU1	BH5-13	6/14/2013	Upper Aquifer		1	0															
OU1	BH05-18	5/10/2018	Upper Aquifer				2200	0	0.57	0	2.4	0	180	1	0.31	0	0.21	0	30	0	3.2
OU1	BH6-13	6/13/2013	Upper Aquifer		1	0															
OU1	BH06-18	5/10/2018	Upper Aquifer				5000	1	1.1	0	5.9	1	280	1	0.53	0	0.21	0	30	0	9
OU1	BH7-13	6/12/2013	Upper Aquifer		1	0															
OU1	BH07-18	5/10/2018	Upper Aquifer				3200	1	0.57	0	2.9	0	190	1	0.52	0	0.21	0	30	0	2.8
OU1	BH8-13	6/13/2013	Upper Aquifer		1	0															
OU1	BH08-18	5/11/2018	Upper Aquifer	0	0.063	0	1100	1	0.57	0	7.5	1	220	1	0.31	0	0.21	0	2.6	1	4.2
OU1	BH9-13	6/11/2013	Upper Aquifer		1	0															
OU1	BH09-18	5/14/2018	Upper Aquifer	0	0.064	0	160	1	0.57	0	19	1	230	1	0.49	1	0.48	1	2.7	1	1.3
OU1	BH10-13	6/11/2013	Upper Aquifer		1	0															
OU1	BH10-18	5/11/2018	Upper Aquifer	0	0.065	0	200	1	0.57	0	1.6	1	280	1	0.31	0	0.21	0	2.2	1	0.42
OU1	BH11-13	6/11/2013	Upper Aquifer		1	0	200	0	10	0	10	0	270	1	5	0	2	0	5	0	7
OU1	BH12-13	6/11/2013	Upper Aquifer		1	0															
OU1	BH13-13	6/12/2013	Upper Aquifer		1	0															
OU1	BH14-13	6/11/2013	Upper Aquifer		1	0															
OU1	BH14-18	9/17/2018	Upper Aquifer	1	0.33	1	39000	1	23	1	110	1	1100	1	2.6	1	14	1	610	1	46
OU1	BH15-13	6/12/2013	Upper Aquifer		1	0															
OU1	BH16-13	6/12/2013	Upper Aquifer		1	0															
OU1	BH16-13	7/10/2013	Upper Aquifer		2	0															
OU1	BH17-13	6/12/2013	Upper Aquifer		1	0															
OU1	BH17-13	7/10/2013	Upper Aquifer		2.9	0															
OU1	BH18-13	6/12/2013	Upper Aquifer		1	0	200	0	10	0	10	0	140	1	5	0	2	0	5	0	3.2
OU1	BH18-13	7/9/2013	Upper Aquifer		1	0	200	0	10	0	10	0	160	1	5	0	2	0	5	0	2
OU1	BH19-13	6/13/2013	Upper Aquifer		1	0															
OU1	BH20-13	6/17/2013	Upper Aquifer		1	0															
OU1	BH20-18	5/15/2018	Upper Aquifer	0	0.1	0	34	0	0.57	0	230	1	260	1	0.31	0	0.21	0	0.98	0	1.7
OU1	BH21-13	6/17/2013	Upper Aquifer		1	0															
OU1	BH22-13	6/17/2013	Upper Aquifer		1	0	200	0	10	0	10	0	110	1	5	0	2	0	5	0	7
OU1	BH23-13	6/18/2013	Upper Aquifer		1	0															
OU1	BH24-13	6/18/2013	Upper Aquifer		1	0															
OU1	BH25-13	6/18/2013	Upper Aquifer		1	0	200	0	10	0	10	0	220	1	5	0	2	0	5	0	7
OU1	BH30-13	7/3/2013	Upper Aquifer		1.4	0	200	0	10	0	10	0	270	1	5	0	2	0	5	0	7
OU1	BH31-13	7/1/2013	Upper Aquifer		2	0															
OU1	BH32-13	7/2/2013	Upper Aquifer		1	0															
OU1	BH33-13	6/27/2013	Upper Aquifer		5.1	1															
OU1	BH34-13	6/27/2013	Upper Aquifer		1	0															
OU1	BH35-13	6/28/2013	Upper Aquifer		1	0															
OU1	BH36-13	7/2/2013	Upper Aquifer		1	0	200	0	10	0	10	0	930	1	5	0	2	0	5	0	7
OU1	BH37-13	7/3/2013	Upper Aquifer		1	0															
OU1	BH38-13	6/28/2013	Upper Aquifer		1	0															
OU1	BH39-13	7/1/2013	Upper Aquifer		1	0															
OU1	BH40-13	7/2/2013	Upper Aquifer		1	0	200	0	10	0	10	0	630	1	5	0	2	0	5	0	2.7
OU1	BH42-13	7/8/2013	Upper Aquifer		1.4	1															
OU1	BH43-13	7/2/2013	Upper Aquifer		1	0															
OU1	BH44-13	7/2/2013	Upper Aquifer		1	0															
OU1	BH46-13	7/2/2013	Upper Aquifer		11	0	200	0	10	0	5.1	1	830	1	5	0	2	0	5	0	7
OU1	BH46B-13	7/3/2013	Upper Aquifer		1	0	200	0	10	0	10	0	570	1	5	0	2	0	5	0	1.8
OU1	BH48B-13	7/8/2013	Upper Aquifer		1	0	200	0	10	0	11	1	660	1	5	0	2	0	5	0	7
OU1	BH49-13	6/18/2013	Upper Aquifer		1	0	200	0	10	0	6	1	1700	1	5	0	2	0	5	0	7
OU1	BH51-13	6/21/2013	Upper Aquifer		0.32	1															
OU1	BH52-13	6/19/2013	Upper Aquifer		1	0															
OU1	BH53-13	6/18/2013	Upper Aquifer		1	0															
OU1	BH54-13	6/18/2013	Upper Aquifer		1	0															
OU1	BH55-13	6/18/2013	Upper Aquifer		1	0															
OU1	BH56-13	6/19/2013	Upper Aquifer		1	0															
OU1	BH57-13	6/19/2013	Upper Aquifer		1	0															
OU1	BH58-13	6/19/2013	Upper Aquifer		1	0															

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South Dayton Dump Site
Moraine, Ohio

				35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_bis(2-Ethylhexyl)phthalate (DEHP)	Naphthalene	D_Naphthalene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Beryllium	Cadmium	D_Cadmium	Chromium	D_Chromium	Cobalt
OU1	BH59-13	6/19/2013	Upper Aquifer		1	0															
OU1	BH60-13	6/19/2013	Upper Aquifer		1	0															
OU1	BH61-13	6/19/2013	Upper Aquifer		1	0															
OU1	BH62-13	6/19/2013	Upper Aquifer		0.43	1															
OU1	BH63-13	6/20/2013	Upper Aquifer		1	0															
OU1	BH64-13	6/19/2013	Upper Aquifer		1	0															
OU1	BH65-13	6/20/2013	Upper Aquifer		1	0															
OU1	BH66-13	6/26/2013	Upper Aquifer		1	0															
OU1	BH67-13	6/20/2013	Upper Aquifer		1	0															
OU1	BH68-13	6/20/2013	Upper Aquifer		1	0															
OU1	BH69-13	6/21/2013	Upper Aquifer		1.7	0															
OU1	BH70-13	6/21/2013	Upper Aquifer		2	0															
OU1	BH71-13	6/20/2013	Upper Aquifer		1	0															
OU1	BH72-13	6/20/2013	Upper Aquifer		1	0															
OU1	BH73-13	6/20/2013	Upper Aquifer		1	0															
OU1	BH74-13	6/20/2013	Upper Aquifer		1	0															
OU1	BH75-13	6/25/2013	Upper Aquifer		1	0															
OU1	BH76-13	6/26/2013	Upper Aquifer		1	0	200	0	10	0	10	0	1900	1	5	0	2	0	3.7	1	7
OU1	BH77-13	6/25/2013	Upper Aquifer		9.8	1															
OU1	BH78-13	6/25/2013	Upper Aquifer		1	0															
OU1	BH79-13	6/26/2013	Upper Aquifer		1	0															
OU1	BH80-13	6/25/2013	Upper Aquifer		1	0															
OU1	BH81-13	6/27/2013	Upper Aquifer		1	0	200	0	10	0	10	0	760	1	5	0	2	0	5	0	7
OU1	BH82-13	6/25/2013	Upper Aquifer		1	0															
OU1	BH83-13	6/25/2013	Upper Aquifer		1	0															
OU1	BH84-13	6/26/2013	Upper Aquifer		1	0															
OU1	BH85-13	6/25/2013	Upper Aquifer		1.3	1	200	0	10	0	21	1	800	1	5	0	2	0	5	0	7
OU1	BH86-13	6/24/2013	Upper Aquifer		2.2	0															
OU1	BH87-13	6/26/2013	Upper Aquifer		1	0															
OU1	BH88-13	6/24/2013	Upper Aquifer		1	0															
OU1	BH89-13	6/24/2013	Upper Aquifer		1	0	200	0	10	0	9.4	1	240	1	5	0	2	0	5	0	4.1
OU1	BH90-13	7/9/2013	Upper Aquifer		1	0															
OU1	BH91-13	6/28/2013	Upper Aquifer		1	0															
OU1	BH92-13	7/9/2013	Upper Aquifer		4.9	1															
OU1	BH93-13	7/9/2013	Upper Aquifer		1.2	1															
OU1	MW-101A	5/13/2015	Upper Aquifer																		
OU1	MW-202	5/12/2015	Upper Aquifer																		
OU1	MW-203	5/13/2015	Upper Aquifer																		
OU1	MW-204	5/11/2015	Upper Aquifer																		
OU1	MW-208	10/4/2017	Upper Aquifer	0	0.061	0	85	1	0.57	0	0.75	0	140	1	0.32	1	0.21	0	0.98	0	2.4
OU1	MW-209	5/12/2015	Upper Aquifer																		
OU1	MW-209	10/17/2018	Upper Aquifer	0	0.1	0	820	1	0.57	0	3.2	1	290	1	0.31	0	0.21	0	1.3	1	0.89
OU1	MW-210	5/15/2015	Upper Aquifer																		
OU1	MW-210	10/3/2017	Upper Aquifer	0	0.063	0															
OU1	MW-210	10/6/2017	Upper Aquifer				61	1	0.57	0	0.75	0	120	1	0.31	0	0.21	0	0.98	0	0.96
OU1	MW-212	5/12/2015	Upper Aquifer																		
OU1	MW-212	10/17/2018	Upper Aquifer	0	0.1	0	150	1	0.57	0	1.1	1	370	1	0.31	0	0.21	0	2.1	1	0.33
OU1	MW-215A	5/13/2015	Upper Aquifer																		
OU1	MW-217	10/17/2018	Upper Aquifer	1	0.11	0	34	0	0.57	0	0.87	1	97	1	0.31	1	0.21	0	0.98	0	1.1
OU1	MW-219	5/13/2015	Upper Aquifer																		
OU1	MW-225	10/5/2017	Upper Aquifer	0	0.06	0	34	0	0.57	0	1.4	1	190	1	0.31	0	0.21	0	0.98	0	0.19
OU1	MW-227	10/4/2017	Upper Aquifer	0	0.063	0	34	0	0.57	0	16	1	240	1	1.6	1	0.46	1	0.98	0	1.1
OU1	MW-229	5/14/2015	Upper Aquifer																		
OU1	MW-230	10/17/2018	Upper Aquifer	0	0.11	0	2100	1	0.57	0	4.2	1	2000	1	0.31	0	0.21	0	4.3	1	8.4
OU1	MW-233	10/18/2018	Upper Aquifer	0	0.1	0	34	0	3	1	0.75	0	200	1	0.31	0	0.21	0	0.98	0	0.3
OU1	MW-235	10/18/2018	Upper Aquifer	0	0.1	0	46	1	0.57	0	3.2	1	190	1	0.63	1	0.21	0	1.8	1	1
OU1	VAS-31	1/19/2018	Upper Aquifer	0	0.06	0	1500	1	0.66	1	2.7	1	270	1	0.31	0	0.21	0	4	1	1.6
OU1	VAS-31	1/19/2018	Upper Aquifer				16000	1	1.1	1	44	1	570	1	0.92	1	0.51	1	26	1	14
OU1	VAS-31	1/22/2018	Upper Aquifer				250	1	1.5	1	1.3	1	99	1	0.35	1	0.29	1	0.98	0	0.56
OU1	VAS-31	1/22/2018	Upper Aquifer	0	0.061	0	61	1	0.57	0	0.75	0	130	1	0.31	0	0.21	0	0.98	0	0.47
OU1	VAS-32	1/8/2018	Upper Aquifer	0	0.06	0	14000	1	2.4	1	56	1	1700	1	1.6	1	2.5	1	86	1	21
OU1	VAS-32	1/8/2018	Upper Aquifer				250	1	0.57	0	1.2	1	310	1	0.31	0	0.21	0	10	1	1.1
OU1	VAS-32	1/8/2018	Upper Aquifer				17000	1	1.4	1	94	1	1100	1	1.2	1	1.3	1	74	1	17
OU1	VAS-32	1/8/2018	Upper Aquifer	1	0.061	0	62000	1	3.8	1	330	1	3000	1	4.1	1	4.1	1	190	1	71
OU1	VAS-33	1/10/2018	Upper Aquifer	0	0.063	0	420	1	0.57	0	120	1	1100	1	0.31	0	0.21	0	2.3	1	1.9
OU1	VAS-33	1/10/2018	Upper Aquifer				46000	1	10	1	820	1	3600	1	4.3	1	2.3	1	240	1	72

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				35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_bis(2-Ethylhexyl)phthalate (DEHP)	Naphthalene	D_Naphthalene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Beryllium	Cadmium	D_Cadmium	Chromium	D_Chromium	Cobalt
OU1	VAS-33	1/10/2018	Upper Aquifer				41	1	0.57	0	2.8	1	150	1	0.31	0	0.21	0	1.4	1	1
OU1	VAS-33	1/10/2018	Upper Aquifer				40	1	0.57	0	3.2	1	110	1	0.31	0	0.21	0	4.5	1	0.58
OU1	VAS-33	1/11/2018	Upper Aquifer	0	0.063	0	54	1	0.57	0	3.1	1	110	1	0.31	0	0.21	0	2.7	1	0.39
OU1	VAS-33	1/11/2018	Upper Aquifer				34	0	0.57	0	3.5	1	110	1	0.31	0	0.21	0	0.98	0	0.19
OU1	VAS-34	2/16/2018	Upper Aquifer	0	0.06	0	39	1	2.3	1	0.75	0	120	1	0.31	0	0.21	0	0.98	0	3.3
OU1	VAS-34	2/16/2018	Upper Aquifer				270	1	0.57	0	2.7	1	120	1	0.31	0	0.21	0	1.4	1	5.2
OU1	VAS-34	2/19/2018	Upper Aquifer				5400	1	0.77	1	33	1	250	1	0.31	1	0.22	1	18	1	6.2
OU1	VAS-34	2/19/2018	Upper Aquifer	0	0.06	0	120	1	0.57	0	0.75	0	110	1	0.31	0	0.21	0	1.3	1	1.1
OU1	VAS-34	2/20/2018	Upper Aquifer				34	0	3.1	1	0.75	0	100	1	0.37	1	0.23	1	0.98	0	0.74
OU1	VAS-37	9/18/2018	Upper Aquifer	1	1.9	1	9900	1	13	1	48	1	1500	1	0.82	1	4	1	33	1	9.4
OU1	VAS-38	2/7/2018	Upper Aquifer	0	0.064	0	6200	1	2.3	1	23	1	500	1	0.58	1	0.38	1	36	1	4.7
OU1	VAS-38	2/7/2018	Upper Aquifer				15000	1	1.2	1	21	1	540	1	0.9	1	0.4	1	35	1	14
OU1	VAS-38	2/7/2018	Upper Aquifer				2300	1	0.57	0	7.5	1	450	1	0.31	0	0.21	0	4	1	2.4
OU1	VAS-38	2/7/2018	Upper Aquifer				1300	1	0.57	0	11	1	730	1	0.31	0	0.21	0	3.5	1	1.3
OU1	VAS-38	2/8/2018	Upper Aquifer				880	1	0.57	0	5.8	1	1300	1	0.31	0	0.21	0	2	1	0.66
OU1	VAS-38	2/8/2018	Upper Aquifer				190	1	0.57	0	2.7	1	960	1	0.31	0	0.21	0	0.98	0	0.3
OU1	VAS-38	2/8/2018	Upper Aquifer				64	1	0.57	0	1.1	1	490	1	0.31	0	0.21	0	0.98	0	0.87
OU1	VAS-38	2/9/2018	Upper Aquifer	0	0.061	0	85	1	0.57	0	5.2	1	500	1	0.31	0	0.21	0	0.98	0	0.4
OU1	VAS-44	1/25/2018	Upper Aquifer				6300	1	5.3	1	16	1	390	1	1.2	1	2.1	1	17	1	11
OU1	VAS-44	1/26/2018	Upper Aquifer				12000	1	8.7	1	30	1	610	1	1.2	1	1.9	1	35	1	15
OU1	VAS-44	1/29/2018	Upper Aquifer				400	1	0.57	0	2.6	1	120	1	0.31	0	0.21	0	2.2	1	1.5
OU1	VAS-44	1/29/2018	Upper Aquifer				1200	1	1.1	1	4.4	1	100	1	0.31	0	0.21	0	3.9	1	3.7
OU1	VAS-44	1/29/2018	Upper Aquifer				34	0	1	1	2.8	1	1900	1	0.31	0	0.21	0	0.98	0	4.7
OU1	VAS-44	1/30/2018	Upper Aquifer				290	1	0.57	0	2.8	1	5000	1	0.31	0	0.21	0	1.2	1	31
OU1	MW-209A	5/13/2015	Lower Aquifer																		
OU1	MW-209A	10/17/2018	Lower Aquifer	0	0.11	0	51	1	0.57	0	3.7	1	360	1	0.31	0	0.21	0	0.98	0	0.61
OU1	MW-210A	5/15/2015	Lower Aquifer																		
OU1	MW-210A	10/3/2017	Lower Aquifer	0	0.066	0	430	1	0.57	0	3.2	1	94	1	0.31	0	0.21	0	0.98	0	0.36
OU1	MW-210B	5/15/2015	Lower Aquifer																		
OU1	MW-210B	10/3/2017	Lower Aquifer	0	0.06	0	88	1	0.57	0	8.1	1	630	1	0.31	0	0.5	1	0.98	0	0.59
OU1	MW-215B	5/13/2015	Lower Aquifer																		
OU1	MW-216	5/14/2015	Lower Aquifer																		
OU1	VAS-15B	12/13/2017	Lower Aquifer				2100	1	1.5	1	5.1	1	120	1	0.31	0	0.27	1	6.2	1	1.5
OU1	VAS-15B	12/13/2017	Lower Aquifer				89	1	0.68	1	2	1	84	1	0.31	0	0.21	0	1.3	1	0.3
OU1	VAS-15B	12/14/2017	Lower Aquifer				34	0	1.2	1	2.9	1	89	1	0.31	0	0.21	0	0.98	0	0.31
OU1	VAS-15B	12/14/2017	Lower Aquifer				43	1	0.57	0	1.3	1	97	1	0.31	0	0.21	0	0.98	0	0.19
OU1	VAS-15B	12/15/2017	Lower Aquifer				1000	1	0.57	1	1.4	1	120	1	0.31	0	0.21	0	3.2	1	1.1
OU1	VAS-22b	9/25/2018	Lower Aquifer				120	1	0.89	1	2.6	1	570	1	0.31	0	0.21	0	0.98	0	0.34
OU1	VAS-22b	9/26/2018	Lower Aquifer				75	1	0.77	1	1.8	1	550	1	0.31	0	0.21	0	2.7	1	0.2
OU1	VAS-22b	9/26/2018	Lower Aquifer				87	1	0.57	0	1.3	1	450	1	0.31	0	0.21	0	0.99	1	0.21
OU1	VAS-22b	9/27/2018	Lower Aquifer				62	1	0.57	0	1.3	1	540	1	0.31	0	0.21	0	0.98	0	0.19
OU1	VAS-22b	9/27/2018	Lower Aquifer				7600	1	1.1	1	6.2	1	620	1	0.5	1	0.21	0	30	1	5.9
OU1	VAS-22b	9/27/2018	Lower Aquifer				880	1	0.57	0	0.75	0	670	1	0.31	0	0.21	0	2.5	1	0.71
OU1	VAS-22b	10/2/2018	Lower Aquifer				850	1	0.57	0	1.1	1	310	1	0.31	0	0.21	0	3.4	1	1
OU1	VAS-22b	10/2/2018	Lower Aquifer				5400	1	0.76	1	2.4	1	270	1	0.7	0	0.21	0	40	1	4
OU1	VAS-22b	10/3/2018	Lower Aquifer				13000	1	0.64	1	7.8	1	320	1	0.58	1	0.23	1	19	1	9.4
OU1	VAS-31	1/22/2018	Lower Aquifer				54	1	0.57	0	1	1	150	1	0.31	0	0.21	0	0.98	0	0.34
OU1	VAS-31	1/23/2018	Lower Aquifer				34	0	0.68	1	3.9	1	290	1	0.31	0	0.21	0	0.98	0	0.39
OU1	VAS-31	1/23/2018	Lower Aquifer				1400	1	0.57	0	2.6	1	410	1	0.31	0	0.21	0	3.6	1	1.2
OU1	VAS-31	1/24/2018	Lower Aquifer				200	1	0.95	0	1.1	1	430	1	0.31	0	0.21	0	0.98	0	0.51
OU1	VAS-32	1/8/2018	Lower Aquifer				42000	1	2.6	1	220	1	2200	1	2.9	1	3.1	1	130	1	46
OU1	VAS-32	1/9/2018	Lower Aquifer				5800	1	6	1	7	1	320	1	0.48	1	0.3	1	93	1	7.4
OU1	VAS-32	1/9/2018	Lower Aquifer				120000	1	2.2	1	110	1	1600	1	5.4	1	4.1	1	300	1	100
OU1	VAS-32	1/9/2018	Lower Aquifer				24000	1	0.95	0	20	1	530	1	1.1	1	0.83	1	130	1	21
OU1	VAS-33	1/11/2018	Lower Aquifer				230	1	0.57	0	4.9	1	120	1	0.31	0	0.21	0	1.2	1	0.48
OU1	VAS-33	1/16/2018	Lower Aquifer				450	1	0.57	0	5.3	1	110	1	0.31	0	0.21	0	5	1	0.54
OU1	VAS-33	1/16/2018	Lower Aquifer				92	1	0.57	0	4.4	1	110	1	0.31	0	0.21	0	0.98	0	0.31
OU1	VAS-33	1/17/2018	Lower Aquifer				73	0	4.9	1	4.3	0	90	1	0.36	1	0.33	1	1.4	1	0.33
OU1	VAS-34	2/20/2018	Lower Aquifer				54	1	1.6	1	2.9	1	110	1	0.31	0	0.21	0	0.98	0	0.39
OU1	VAS-34	2/20/2018	Lower Aquifer				580	1	0.57	0	6.2	1	93	1	0.31	0	0.21	0	6.1	1	0.76
OU1	VAS-34	2/21/2018	Lower Aquifer				34	1	1.7	1	4.1	1	99	1	0.45	1	0.29	1	1.1	1	0.41
OU1	VAS-34	2/21/2018	Lower Aquifer				1900	1	1.2	1	5.6	1	140	1	0.44	1	0.28	1	11	1	2.2
OU1	VAS-34	2/21/2018	Lower Aquifer				680	1	0.7	1	3.8	1	88	1	0.31	0	0.21	0	25	1	1
OU1	VAS-34	2/22/2018	Lower Aquifer				93	1	1.8	1	1.2	1	84	1	0.31	0	0.31	1	1.9	1	0.59
OU1	VAS-34	2/22/2018	Lower Aquifer				3800	1	1.1	1	4.7	1	120	1	0.31	0	0.28	1	39	1	4.4
OU1	VAS-34	2/22/2018	Lower Aquifer				980	1	0.6	1	4.1	1	120	1	0.31	0	0.21	0	31	1	1.4

Table B.20.1

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_bis(2-Ethylhexyl)phthalate (DEHP)	Naphthalene	D_Naphthalene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Beryllium	Cadmium	D_Cadmium	Chromium	D_Chromium	Cobalt
OU1	VAS-34	2/23/2018	Lower Aquifer				37	1	0.57	0	2.2	1	120	0	0.31	0	0.21	0	0.98	0	0.19
OU1	VAS-37	9/19/2018	Lower Aquifer				50	1	0.57	0	3.3	1	300	1	0.31	0	0.21	0	0.98	0	0.31
OU1	VAS-37	9/19/2018	Lower Aquifer				230	1	0.57	0	2.9	1	160	1	0.31	0	0.21	0	1.3	1	0.49
OU1	VAS-37	9/19/2018	Lower Aquifer	0	0.1	0	310	1	0.57	0	3.5	1	130	1	0.31	0	0.21	0	0.98	0	0.59
OU1	VAS-37	9/20/2018	Lower Aquifer				34	0	0.57	0	1.2	1	120	1	0.31	0	0.21	0	0.98	0	0.61
OU1	VAS-37	9/20/2018	Lower Aquifer				920	1	0.57	0	2.5	1	120	1	0.31	0	0.21	0	7.5	1	1.3
OU1	VAS-37	9/21/2018	Lower Aquifer				150	1	0.57	0	2	1	120	1	0.31	0	0.21	0	0.98	0	0.67
OU1	VAS-37	9/24/2018	Lower Aquifer				50	1	0.57	0	1.7	1	110	1	0.45	1	0.21	0	0.98	0	0.81
OU1	VAS-37	9/24/2018	Lower Aquifer				3300	1	0.57	0	3.7	1	150	1	0.84	1	0.21	0	19	1	3.1
OU1	VAS-38	2/13/2018	Lower Aquifer				66	1	1.2	0	1.7	1	190	1	0.31	0	0.21	0	1.2	1	0.51
OU1	VAS-38	2/13/2018	Lower Aquifer				120	1	0.57	0	2.8	1	490	1	0.31	0	0.21	0	1.1	1	0.41
OU1	VAS-38	2/14/2018	Lower Aquifer				34		1.4	0	2.7	1	730	1	0.31	0	0.21	0	0.98	0	0.47
OU1	VAS-44	1/30/2018	Lower Aquifer				750	1	0.57	0	7.1	1	130	1	0.31	0	0.21	0	3	1	0.51
OU1	VAS-44	1/31/2018	Lower Aquifer				260	1	1.4	0	4.9	1	140	1	0.31	0	0.22	1	5.1	1	0.48
OU1	VAS-44	1/31/2018	Lower Aquifer				170	1	0.57	0	4.9	1	130	1	0.31	0	0.21	0	3.8	1	0.39
OU1	VAS-44	2/1/2018	Lower Aquifer				48	1	0.85	0	5.6	1	110	1	0.31	0	0.21	0	0.98	0	0.28
OU1	VAS-44	2/1/2018	Lower Aquifer				220	1	0.57	0	4.6	1	110	1	0.31	0	0.21	0	3.6	1	0.42
OU1	VAS-44	2/5/2018	Lower Aquifer				34	0	1.9	0	5	1	110	1	0.42	1	0.28	1	0.98	0	0.27
OU1	VAS-44	2/5/2018	Lower Aquifer				57	1	0.9	0	4.7	1	110	1	0.31	0	0.21	0	0.98	0	0.27
OU1	VAS-44	2/6/2018	Lower Aquifer				280	1	0.57	0	2.3	1	100	0	0.31	0	0.21	0	1.1	1	0.39

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel
OU1	BH1-13	6/13/2013	Upper Aquifer	0	25	0			700	1	3	0	120	1	0.2	0	6.5	1
OU1	BH01-18	5/8/2018	Upper Aquifer	1	4.5	1			1300	1	0.45	0	240	1	0.13	0	7.1	1
OU1	BH2-13	6/14/2013	Upper Aquifer	1	25	0			540	1	3	0	310	1	0.2	0	8.6	1
OU1	BH02-18	5/8/2018	Upper Aquifer	1	330	1			15000	1	24	1	1700	1	0.13	0	40	1
OU1	BH3-13	6/14/2013	Upper Aquifer															
OU1	BH03-18	5/7/2018	Upper Aquifer	1	11	1			2400	1	1.2	1	280	1	0.13	0	18	1
OU1	BH4-13	6/14/2013	Upper Aquifer	0	25	0			110	1	3	0	370	1	0.2	0	15	1
OU1	BH04-18	5/8/2018	Upper Aquifer	1	1.7	0			1400	1	0.45	0	120	1	0.13	0	8.3	1
OU1	BH5-13	6/14/2013	Upper Aquifer															
OU1	BH05-18	5/10/2018	Upper Aquifer	0	52	0			7300	0	6.6	1	540	1	0.13	0	32	0
OU1	BH6-13	6/13/2013	Upper Aquifer															
OU1	BH06-18	5/10/2018	Upper Aquifer	1	52	0			10000	1	4.3	0	1300	1	0.13	0	32	0
OU1	BH7-13	6/12/2013	Upper Aquifer															
OU1	BH07-18	5/10/2018	Upper Aquifer	0	52	0			7300	0	3.8	0	220	0	0.13	0	32	0
OU1	BH8-13	6/13/2013	Upper Aquifer															
OU1	BH08-18	5/11/2018	Upper Aquifer	1	3.3	1	390	1	3300	1	1.5	1	430	1	0.13	0	7.3	1
OU1	BH9-13	6/11/2013	Upper Aquifer															
OU1	BH09-18	5/14/2018	Upper Aquifer	1	3.7	1	12	0	11000	1	1.6	1	210	1	0.13	0	2.2	1
OU1	BH10-13	6/11/2013	Upper Aquifer															
OU1	BH10-18	5/11/2018	Upper Aquifer	1	1.7	0	10	0	4500	1	0.66	1	620	1	0.13	0	2.7	1
OU1	BH11-13	6/11/2013	Upper Aquifer	0	25	0			510	1	3	0	140	1	0.2	0	13	1
OU1	BH12-13	6/11/2013	Upper Aquifer															
OU1	BH13-13	6/12/2013	Upper Aquifer															
OU1	BH14-13	6/11/2013	Upper Aquifer															
OU1	BH14-18	9/17/2018	Upper Aquifer	1	1900	1	6	0	250000	1	1400	1	15000	1	0.32	0	300	1
OU1	BH15-13	6/12/2013	Upper Aquifer															
OU1	BH16-13	6/12/2013	Upper Aquifer															
OU1	BH16-13	7/10/2013	Upper Aquifer															
OU1	BH17-13	6/12/2013	Upper Aquifer															
OU1	BH17-13	7/10/2013	Upper Aquifer															
OU1	BH18-13	6/12/2013	Upper Aquifer	1	25	0			2500	1	3	0	430	1	0.2	0	11	1
OU1	BH18-13	7/9/2013	Upper Aquifer	1	25	0			760	1	1.9	1	260	1	0.2	0	7.9	1
OU1	BH19-13	6/13/2013	Upper Aquifer															
OU1	BH20-13	6/17/2013	Upper Aquifer															
OU1	BH20-18	5/15/2018	Upper Aquifer	1	1.7	0	6	0	13000	1	0.45	0	70	1	0.13	0	3	1
OU1	BH21-13	6/17/2013	Upper Aquifer															
OU1	BH22-13	6/17/2013	Upper Aquifer	0	25	0			150	1	3	0	440	1	0.2	0	7.4	1
OU1	BH23-13	6/18/2013	Upper Aquifer															
OU1	BH24-13	6/18/2013	Upper Aquifer															
OU1	BH25-13	6/18/2013	Upper Aquifer	0	25	0			610	1	3	0	280	1	0.2	0	5.8	1
OU1	BH30-13	7/3/2013	Upper Aquifer	0	25	0			1200	1	3	0	150	1	0.2	0	40	0
OU1	BH31-13	7/1/2013	Upper Aquifer															
OU1	BH32-13	7/2/2013	Upper Aquifer															
OU1	BH33-13	6/27/2013	Upper Aquifer															
OU1	BH34-13	6/27/2013	Upper Aquifer															
OU1	BH35-13	6/28/2013	Upper Aquifer															
OU1	BH36-13	7/2/2013	Upper Aquifer	0	25	0			2100	1	3	0	1200	1	0.2	0	14	1
OU1	BH37-13	7/3/2013	Upper Aquifer															
OU1	BH38-13	6/28/2013	Upper Aquifer															
OU1	BH39-13	7/1/2013	Upper Aquifer			0												
OU1	BH40-13	7/2/2013	Upper Aquifer	1	25				2600	1	3	0	720	1	0.2	0	7.3	1
OU1	BH42-13	7/8/2013	Upper Aquifer															
OU1	BH43-13	7/2/2013	Upper Aquifer															
OU1	BH44-13	7/2/2013	Upper Aquifer															
OU1	BH46-13	7/2/2013	Upper Aquifer	0	25	0			24000	1	3	0	280	1	0.2	0	40	0
OU1	BH46B-13	7/3/2013	Upper Aquifer	1	25	0			2400	1	3	0	1000	1	0.2	0	40	0
OU1	BH48B-13	7/8/2013	Upper Aquifer	0	25	0			12000	1	3	0	230	1	0.2	0	4.2	1
OU1	BH49-13	6/18/2013	Upper Aquifer	0	25	0			8400	1	3	0	440	1	0.2	0	4.4	1
OU1	BH51-13	6/21/2013	Upper Aquifer															
OU1	BH52-13	6/19/2013	Upper Aquifer															
OU1	BH53-13	6/18/2013	Upper Aquifer															
OU1	BH54-13	6/18/2013	Upper Aquifer															
OU1	BH55-13	6/18/2013	Upper Aquifer															
OU1	BH56-13	6/19/2013	Upper Aquifer															
OU1	BH57-13	6/19/2013	Upper Aquifer															
OU1	BH58-13	6/19/2013	Upper Aquifer															

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel
OU1	BH59-13	6/19/2013	Upper Aquifer															
OU1	BH60-13	6/19/2013	Upper Aquifer															
OU1	BH61-13	6/19/2013	Upper Aquifer															
OU1	BH62-13	6/19/2013	Upper Aquifer															
OU1	BH63-13	6/20/2013	Upper Aquifer															
OU1	BH64-13	6/19/2013	Upper Aquifer															
OU1	BH65-13	6/20/2013	Upper Aquifer															
OU1	BH66-13	6/26/2013	Upper Aquifer															
OU1	BH67-13	6/20/2013	Upper Aquifer															
OU1	BH68-13	6/20/2013	Upper Aquifer															
OU1	BH69-13	6/21/2013	Upper Aquifer															
OU1	BH70-13	6/21/2013	Upper Aquifer															
OU1	BH71-13	6/20/2013	Upper Aquifer															
OU1	BH72-13	6/20/2013	Upper Aquifer															
OU1	BH73-13	6/20/2013	Upper Aquifer															
OU1	BH74-13	6/20/2013	Upper Aquifer															
OU1	BH75-13	6/25/2013	Upper Aquifer			0												
OU1	BH76-13	6/26/2013	Upper Aquifer	0	25				26000	1	3	0	270	1	0.2	0	40	0
OU1	BH77-13	6/25/2013	Upper Aquifer															
OU1	BH78-13	6/25/2013	Upper Aquifer															
OU1	BH79-13	6/26/2013	Upper Aquifer															
OU1	BH80-13	6/25/2013	Upper Aquifer															
OU1	BH81-13	6/27/2013	Upper Aquifer	0	25	0			5600	1	3	0	150	1	0.2	0	4.6	1
OU1	BH82-13	6/25/2013	Upper Aquifer															
OU1	BH83-13	6/25/2013	Upper Aquifer															
OU1	BH84-13	6/26/2013	Upper Aquifer															
OU1	BH85-13	6/25/2013	Upper Aquifer	0	25	0			1500	1	3	0	100	1	0.2	0	40	0
OU1	BH86-13	6/24/2013	Upper Aquifer															
OU1	BH87-13	6/26/2013	Upper Aquifer															
OU1	BH88-13	6/24/2013	Upper Aquifer															
OU1	BH89-13	6/24/2013	Upper Aquifer	1	25	0			3100	1	3	0	480	1	0.2	0	9.1	1
OU1	BH90-13	7/9/2013	Upper Aquifer															
OU1	BH91-13	6/28/2013	Upper Aquifer															
OU1	BH92-13	7/9/2013	Upper Aquifer															
OU1	BH93-13	7/9/2013	Upper Aquifer															
OU1	MW-101A	5/13/2015	Upper Aquifer															
OU1	MW-202	5/12/2015	Upper Aquifer															
OU1	MW-203	5/13/2015	Upper Aquifer															
OU1	MW-204	5/11/2015	Upper Aquifer															
OU1	MW-208	10/4/2017	Upper Aquifer	1	1.7	0	86	1	200	1	0.45	0	710	1	0.13	0	1.5	0
OU1	MW-209	5/12/2015	Upper Aquifer															
OU1	MW-209	10/17/2018	Upper Aquifer	1	1.8	1	6	0	2000	1	1.3	1	220	1	0.13	0	3.2	1
OU1	MW-210	5/15/2015	Upper Aquifer															
OU1	MW-210	10/3/2017	Upper Aquifer				5	0										
OU1	MW-210	10/6/2017	Upper Aquifer	1	1.7	0			200	1	0.45	0	610	1	0.13	0	1.5	1
OU1	MW-212	5/12/2015	Upper Aquifer															
OU1	MW-212	10/17/2018	Upper Aquifer	1	1.7	0	6	0	640	1	0.45	0	36	1	0.13	0	2.3	1
OU1	MW-215A	5/13/2015	Upper Aquifer															
OU1	MW-217	10/17/2018	Upper Aquifer	1	1.7	0	6	0	200	1	0.45	0	710	1	0.13	0	4.4	1
OU1	MW-219	5/13/2015	Upper Aquifer															
OU1	MW-225	10/5/2017	Upper Aquifer	0	1.9	1	5	0	47	0	0.45	0	11	1	0.13	0	1.5	0
OU1	MW-227	10/4/2017	Upper Aquifer	1	1.7	0	5	0	8600	1	0.84	1	180	1	0.13	0	1.5	0
OU1	MW-229	5/14/2015	Upper Aquifer															
OU1	MW-230	10/17/2018	Upper Aquifer	1	17	1	6	0	3700	1	3.4	1	2600	1	0.13	0	26	1
OU1	MW-233	10/18/2018	Upper Aquifer	1	1.8	1	6	0	56	1	0.45	0	2.5	1	0.13	0	1.5	0
OU1	MW-235	10/18/2018	Upper Aquifer	1	1.7	0	28	1	6900	1	0.45	0	100	1	0.13	0	2.1	1
OU1	VAS-31	1/19/2018	Upper Aquifer	1	12	1	6	0	3400	1	72	1	270	1	0.13	0	4.8	1
OU1	VAS-31	1/19/2018	Upper Aquifer	1	50	1			39000	1	28	1	1700	1	0.13	0	36	1
OU1	VAS-31	1/22/2018	Upper Aquifer	1	5.5	1			710	1	0.68	1	400	1	0.13	0	1.6	1
OU1	VAS-31	1/22/2018	Upper Aquifer	1	1.7	0	6	0	870	1	0.45	0	420	1	0.13	0	1.7	1
OU1	VAS-32	1/8/2018	Upper Aquifer	1	68	1	7.4	1	41000	1	78	1	2000	1	0.13	0	80	1
OU1	VAS-32	1/8/2018	Upper Aquifer	1	2.4	1			870	1	0.83	1	710	1	0.13	0	7.9	1
OU1	VAS-32	1/8/2018	Upper Aquifer	1	68	1			49000	1	42	1	1800	1	0.13	0	67	1
OU1	VAS-32	1/8/2018	Upper Aquifer	1	260	1	7.8	1	250000	1	170	1	5700	1	0.3	1	220	1
OU1	VAS-33	1/10/2018	Upper Aquifer	1	3.9	1	150	1	12000	1	3.1	1	350	1	0.13	0	3.2	1
OU1	VAS-33	1/10/2018	Upper Aquifer	1	330	1			390000	1	310	1	5600	1	0.24	1	260	1

Table B.20.1

Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel
OU1	VAS-33	1/10/2018	Upper Aquifer	1	1.7	0			3200	1	0.76	1	350	1	0.13	0	1.6	1
OU1	VAS-33	1/10/2018	Upper Aquifer	1	4.4	1			1400	1	0.5	1	470	1	0.13	0	4.4	1
OU1	VAS-33	1/11/2018	Upper Aquifer	1	5.8	1	6	0	3200	1	0.82	1	650	1	0.13	0	2.4	1
OU1	VAS-33	1/11/2018	Upper Aquifer	0	3.1	1			2400	1	0.45	0	450	1	0.13	0	1.5	0
OU1	VAS-34	2/16/2018	Upper Aquifer	1	2	1	580	1	430	1	0.45	0	830	1	0.13	0	1.5	0
OU1	VAS-34	2/16/2018	Upper Aquifer	1	13	1			1200	1	0.91	1	780	1	0.13	0	2.7	1
OU1	VAS-34	2/19/2018	Upper Aquifer	1	90	1			22000	1	21	1	980	1	0.13	0	17	1
OU1	VAS-34	2/19/2018	Upper Aquifer	1	3.3	1	6	0	590	1	0.63	1	820	1	0.13	0	2.5	1
OU1	VAS-34	2/20/2018	Upper Aquifer	1	1.7	0			2000	1	0.58	1	790	1	0.13	0	2.2	1
OU1	VAS-37	9/18/2018	Upper Aquifer	1	170	1	6	0	32000	1	340	1	580	1	0.18	0	46	1
OU1	VAS-38	2/7/2018	Upper Aquifer	1	24	1	6	0	19000	1	14	1	1300	1	0.13	0	13	1
OU1	VAS-38	2/7/2018	Upper Aquifer	1	58	1			35000	1	27	1	1000	1	0.13	0	36	1
OU1	VAS-38	2/7/2018	Upper Aquifer	1	7.9	1			4500	1	2	1	170	1	0.13	0	6.1	1
OU1	VAS-38	2/7/2018	Upper Aquifer	1	12	1			3700	1	2.1	1	55	1	0.13	0	3.9	1
OU1	VAS-38	2/8/2018	Upper Aquifer	1	3.2	1			3300	1	1.1	1	38	1	0.13	0	2.3	1
OU1	VAS-38	2/8/2018	Upper Aquifer	1	1.7	1			1000	1	0.45	0	19	1	0.13	0	1.5	0
OU1	VAS-38	2/8/2018	Upper Aquifer	1	1.7	0			360	1	0.59	1	45	1	0.13	0	3.6	1
OU1	VAS-38	2/9/2018	Upper Aquifer	1	1.7	0	6	0	2300	1	0.45	0	31	1	0.13	0	3.2	1
OU1	VAS-44	1/25/2018	Upper Aquifer	1	84	1			21000	1	140	1	820	1	0.56	1	29	1
OU1	VAS-44	1/26/2018	Upper Aquifer	1	110	1			44000	1	150	1	1200	1	0.36	1	47	1
OU1	VAS-44	1/29/2018	Upper Aquifer	1	3.6	1			2100	1	4	1	370	1	0.13	0	3	1
OU1	VAS-44	1/29/2018	Upper Aquifer	1	6.8	1			3800	1	2.5	1	96	1	0.13	0	4.4	1
OU1	VAS-44	1/29/2018	Upper Aquifer	1	1.7	1			950	1	0.45	0	26	1	0.13	0	2.1	1
OU1	VAS-44	1/30/2018	Upper Aquifer	1	7.9	1			900	1	0.45	0	18	1	0.13	0	22	1
OU1	MW-209A	5/13/2015	Lower Aquifer															
OU1	MW-209A	10/17/2018	Lower Aquifer	1	1.7	0	6	0	2000	1	0.45	0	280	1	0.13	0	1.9	1
OU1	MW-210A	5/15/2015	Lower Aquifer															
OU1	MW-210A	10/3/2017	Lower Aquifer	1	1.7	0	5	0	2700	1	0.52	1	190	1	0.13	0	1.5	0
OU1	MW-210B	5/15/2015	Lower Aquifer															
OU1	MW-210B	10/3/2017	Lower Aquifer	1	1.7	0	5	0	4500	1	0.61	1	37	1	0.13	0	1.5	0
OU1	MW-215B	5/13/2015	Lower Aquifer															
OU1	MW-216	5/14/2015	Lower Aquifer															
OU1	VAS-15B	12/13/2017	Lower Aquifer	1	5.2				10000	1	2.8	1	320	1	0.13	0	5.5	1
OU1	VAS-15B	12/13/2017	Lower Aquifer	1	1.7	0			3700	1	0.45	0	260	1	0.13	0	2.2	1
OU1	VAS-15B	12/14/2017	Lower Aquifer	1	1.7	0			2400	1	0.45	0	290	1	0.13	0	1.5	0
OU1	VAS-15B	12/14/2017	Lower Aquifer	0	1.7	0			4000	1	0.45	0	300	1	0.13	0	1.5	0
OU1	VAS-15B	12/15/2017	Lower Aquifer	1	3	1			5600	1	1.9	1	310	1	0.13	0	3.3	1
OU1	VAS-22b	9/25/2018	Lower Aquifer	1	1.7	0			1500	1	0.45	0	120	1	0.13	0	1.5	0
OU1	VAS-22b	9/26/2018	Lower Aquifer	1	1.7	0			1500	1	0.45	0	100	1	0.13	0	1.5	0
OU1	VAS-22b	9/26/2018	Lower Aquifer	1	1.7	0			2300	1	0.45	0	88	1	0.13	0	1.5	0
OU1	VAS-22b	9/27/2018	Lower Aquifer	0	1.7	0			3900	1	0.45	0	72	1	0.13	0	1.5	0
OU1	VAS-22b	9/27/2018	Lower Aquifer	1	26	1			21000	1	10	1	630	1	0.13	0	17	1
OU1	VAS-22b	9/27/2018	Lower Aquifer	1	3.2	1			2800	1	1.5	1	210	1	0.13	0	2	1
OU1	VAS-22b	10/2/2018	Lower Aquifer	1	8.7	1			9000	1	3	1	300	1	0.13	0	4	1
OU1	VAS-22b	10/2/2018	Lower Aquifer	1	20	1			17000	1	6.4	1	500	1	0.13	0	13	1
OU1	VAS-22b	10/3/2018	Lower Aquifer	1	27	1			24000	1	14	1	850	1	0.13	0	24	1
OU1	VAS-31	1/22/2018	Lower Aquifer	1	1.7	0			480	1	0.45	0	320	1	0.13	0	1.5	0
OU1	VAS-31	1/23/2018	Lower Aquifer	1	1.7	0			1500	1	0.45	0	190	1	0.13	0	2	1
OU1	VAS-31	1/23/2018	Lower Aquifer	1	5.8	1			5200	1	1.7	1	150	1	0.13	0	3.9	1
OU1	VAS-31	1/24/2018	Lower Aquifer	1	1.8	0			2300	1	0.45	0	110	1	0.13	0	2.1	1
OU1	VAS-32	1/8/2018	Lower Aquifer	1	180	1			140000	1	120	1	5100	1	0.24	1	140	1
OU1	VAS-32	1/9/2018	Lower Aquifer	1	17	1			16000	1	8.7	1	1100	1	0.13	0	50	1
OU1	VAS-32	1/9/2018	Lower Aquifer	1	370	1			300000	1	220	1	7500	1	0.22	1	310	1
OU1	VAS-32	1/9/2018	Lower Aquifer	1	87	1			56000	1	39	1	2000	1	0.13	0	84	1
OU1	VAS-33	1/11/2018	Lower Aquifer	1	5.6	1			3900	1	0.45	0	240	1	0.13	0	1.9	1
OU1	VAS-33	1/16/2018	Lower Aquifer	1	1.8	1			4600	1	0.6	1	200	1	0.13	0	2.8	1
OU1	VAS-33	1/16/2018	Lower Aquifer	1	1.7	0			2100	1	0.45	0	220	1	0.13	0	1.5	0
OU1	VAS-33	1/17/2018	Lower Aquifer	1	10	0			3400	1	0.45	0	220	1	0.13	0	1.6	1
OU1	VAS-34	2/20/2018	Lower Aquifer	1	1.7	0			1300	1	0.45	0	420	1	0.13	0	2.2	1
OU1	VAS-34	2/20/2018	Lower Aquifer	1	3.3	1			6500	1	1.3	1	210	1	0.13	0	3	1
OU1	VAS-34	2/21/2018	Lower Aquifer	1	1.7	0			6100	1	0.45	0	190	1	0.13	0	2	1
OU1	VAS-34	2/21/2018	Lower Aquifer	1	30	1			7900	1	40	1	240	1	0.13	0	6.8	1
OU1	VAS-34	2/21/2018	Lower Aquifer	1	23	1			10000	1	11	1	260	1	0.13	0	5.6	1
OU1	VAS-34	2/22/2018	Lower Aquifer	1	1.7	1			11000	1	0.53	1	240	1	0.13	0	3.9	1
OU1	VAS-34	2/22/2018	Lower Aquifer	1	36	1			26000	1	10	1	690	1	0.13	0	17	1
OU1	VAS-34	2/22/2018	Lower Aquifer	1	13	1			13000	1	3.2	1	420	1	0.13	0	6.4	1

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				53	54	55	56	57	58	59	60	61	62	63	64	65	66	67
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	D_Cobalt	Copper	D_Copper	Cyanide (total)	D_Cyanide (total)	Iron	D_Iron	Lead	D_Lead	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel
OU1	VAS-34	2/23/2018	Lower Aquifer	0	2.7	0			2800	1	0.45	0	260	1	0.13	0	1.5	0
OU1	VAS-37	9/19/2018	Lower Aquifer	1	1.7	0			3200	1	1.5	1	41	1	0.13	0	2.2	1
OU1	VAS-37	9/19/2018	Lower Aquifer	1	1.7	0			4200	1	2.2	1	110	1	0.13	0	1.5	0
OU1	VAS-37	9/19/2018	Lower Aquifer	1	1.7	0	6	0	3900	1	1.6	1	120	1	0.13	0	1.5	0
OU1	VAS-37	9/20/2018	Lower Aquifer	1	1.7	0			3600	1	0.45	0	210	1	0.15	1	1.5	0
OU1	VAS-37	9/20/2018	Lower Aquifer	1	54	0			7200	1	2.5	0	420	1	0.13	0	3.7	1
OU1	VAS-37	9/21/2018	Lower Aquifer	1	2	1			8000	1	0.51	1	280	1	0.2	1	1.6	1
OU1	VAS-37	9/24/2018	Lower Aquifer	1	1.7	0			6100	1	0.45	0	250	1	0.13	0	1.5	0
OU1	VAS-37	9/24/2018	Lower Aquifer	1	14	1			16000	1	5.3	1	440	1	0.13	0	9.2	1
OU1	VAS-38	2/13/2018	Lower Aquifer	1	10	1			6100	1	0.83	1	87	1	0.13	0	3	1
OU1	VAS-38	2/13/2018	Lower Aquifer	1	2.7	1			2100	1	0.45	0	58	1	0.13	0	2.7	1
OU1	VAS-38	2/14/2018	Lower Aquifer	1	12	1			5600	1	0.8	1	58	1	0.13	0	1.9	1
OU1	VAS-44	1/30/2018	Lower Aquifer	1	1.7	0			3500	1	0.93	1	110	1	0.13	0	2.7	1
OU1	VAS-44	1/31/2018	Lower Aquifer	1	1.7	1			2400	1	0.54	1	100	1	0.13	0	3.7	1
OU1	VAS-44	1/31/2018	Lower Aquifer	1	7.1	1			1500	1	0.6	1	110	1	0.13	0	2.9	1
OU1	VAS-44	2/1/2018	Lower Aquifer	1	3.8	1			1400	1	0.45	0	110	1	0.13	0	1.5	0
OU1	VAS-44	2/1/2018	Lower Aquifer	1	3	1			3700	1	1.1	1	140	1	0.13	0	2.1	1
OU1	VAS-44	2/5/2018	Lower Aquifer	1	4.8	1			1600	1	0.47	1	140	1	0.13	0	1.5	0
OU1	VAS-44	2/5/2018	Lower Aquifer	1	1.7	0			1400	1	0.45	0	180	1	0.13	0	1.5	0
OU1	VAS-44	2/6/2018	Lower Aquifer	1	4.1	0			1400	1	0.55	1	270	1	0.13	0	1.6	1

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Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				68	69	70	71	72	73	74	75
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	Selenium	D_Selenium	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc
OU1	BH1-13	6/13/2013	Upper Aquifer	26	1	10	0	7	0	50	0
OU1	BH01-18	5/8/2018	Upper Aquifer	8.8	1	0.2	0	1.4	1	15	0
OU1	BH2-13	6/14/2013	Upper Aquifer	24	1	10	0	7	0	50	0
OU1	BH02-18	5/8/2018	Upper Aquifer	15	1	0.66	1	13	1	310	1
OU1	BH3-13	6/14/2013	Upper Aquifer								
OU1	BH03-18	5/7/2018	Upper Aquifer	7	1	0.3	1	2	1	17	1
OU1	BH4-13	6/14/2013	Upper Aquifer	6.6	1	10	0	7	0	50	0
OU1	BH04-18	5/8/2018	Upper Aquifer	25	1	0.2	0	1.4	1	15	0
OU1	BH5-13	6/14/2013	Upper Aquifer								
OU1	BH05-18	5/10/2018	Upper Aquifer	2.3	0	0.2	0	5.8	0	170	0
OU1	BH6-13	6/13/2013	Upper Aquifer								
OU1	BH06-18	5/10/2018	Upper Aquifer	1.4	0	0.6	0	14	1	170	0
OU1	BH7-13	6/12/2013	Upper Aquifer								
OU1	BH07-18	5/10/2018	Upper Aquifer	2.9	0	0.2	0	7.5	0	170	0
OU1	BH8-13	6/13/2013	Upper Aquifer								
OU1	BH08-18	5/11/2018	Upper Aquifer	5.6	1	0.2	0	2.8	1	20	1
OU1	BH9-13	6/11/2013	Upper Aquifer								
OU1	BH09-18	5/14/2018	Upper Aquifer	1.1	1	0.2	1	0.89	1	15	0
OU1	BH10-13	6/11/2013	Upper Aquifer								
OU1	BH10-18	5/11/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	18	1
OU1	BH11-13	6/11/2013	Upper Aquifer	5.1	1	10	0	7	0	50	0
OU1	BH12-13	6/11/2013	Upper Aquifer								
OU1	BH13-13	6/12/2013	Upper Aquifer								
OU1	BH14-13	6/11/2013	Upper Aquifer								
OU1	BH14-18	9/17/2018	Upper Aquifer	10	1	1.6	1	110	1	2100	1
OU1	BH15-13	6/12/2013	Upper Aquifer								
OU1	BH16-13	6/12/2013	Upper Aquifer								
OU1	BH16-13	7/10/2013	Upper Aquifer								
OU1	BH17-13	6/12/2013	Upper Aquifer								
OU1	BH17-13	7/10/2013	Upper Aquifer								
OU1	BH18-13	6/12/2013	Upper Aquifer	5	0	10	0	7	0	50	0
OU1	BH18-13	7/9/2013	Upper Aquifer	5	0	10	0	7	0	50	0
OU1	BH19-13	6/13/2013	Upper Aquifer								
OU1	BH20-13	6/17/2013	Upper Aquifer								
OU1	BH20-18	5/15/2018	Upper Aquifer	1.1	1	0.2	0	0.82	0	15	0
OU1	BH21-13	6/17/2013	Upper Aquifer								
OU1	BH22-13	6/17/2013	Upper Aquifer	5	0	5.5	1	7	0	50	0
OU1	BH23-13	6/18/2013	Upper Aquifer								
OU1	BH24-13	6/18/2013	Upper Aquifer								
OU1	BH25-13	6/18/2013	Upper Aquifer	5	0	5.1	1	7	0	50	0
OU1	BH30-13	7/3/2013	Upper Aquifer	11	1	10	0	7	0	50	0
OU1	BH31-13	7/1/2013	Upper Aquifer								
OU1	BH32-13	7/2/2013	Upper Aquifer								
OU1	BH33-13	6/27/2013	Upper Aquifer								
OU1	BH34-13	6/27/2013	Upper Aquifer								
OU1	BH35-13	6/28/2013	Upper Aquifer								
OU1	BH36-13	7/2/2013	Upper Aquifer	5	0	6.7	1	7	0	51	0
OU1	BH37-13	7/3/2013	Upper Aquifer								
OU1	BH38-13	6/28/2013	Upper Aquifer								
OU1	BH39-13	7/1/2013	Upper Aquifer								
OU1	BH40-13	7/2/2013	Upper Aquifer	5	0	5	1	7	0	50	0
OU1	BH42-13	7/8/2013	Upper Aquifer								
OU1	BH43-13	7/2/2013	Upper Aquifer								
OU1	BH44-13	7/2/2013	Upper Aquifer								
OU1	BH46-13	7/2/2013	Upper Aquifer	5	0	4.9	1	7	0	50	0
OU1	BH46B-13	7/3/2013	Upper Aquifer	8	1	10	0	7	0	50	0
OU1	BH48B-13	7/8/2013	Upper Aquifer	5	0	10	0	7	0	51	1
OU1	BH49-13	6/18/2013	Upper Aquifer	5	0	5.9	1	7	0	50	0
OU1	BH51-13	6/21/2013	Upper Aquifer								
OU1	BH52-13	6/19/2013	Upper Aquifer								
OU1	BH53-13	6/18/2013	Upper Aquifer								
OU1	BH54-13	6/18/2013	Upper Aquifer								
OU1	BH55-13	6/18/2013	Upper Aquifer								
OU1	BH56-13	6/19/2013	Upper Aquifer								
OU1	BH57-13	6/19/2013	Upper Aquifer								
OU1	BH58-13	6/19/2013	Upper Aquifer								

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South Dayton Dump Site
Moraine, Ohio

				68	69	70	71	72	73	74	75
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	Selenium	D_Selenium	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc
OU1	BH59-13	6/19/2013	Upper Aquifer								
OU1	BH60-13	6/19/2013	Upper Aquifer								
OU1	BH61-13	6/19/2013	Upper Aquifer								
OU1	BH62-13	6/19/2013	Upper Aquifer								
OU1	BH63-13	6/20/2013	Upper Aquifer								
OU1	BH64-13	6/19/2013	Upper Aquifer								
OU1	BH65-13	6/20/2013	Upper Aquifer								
OU1	BH66-13	6/26/2013	Upper Aquifer								
OU1	BH67-13	6/20/2013	Upper Aquifer								
OU1	BH68-13	6/20/2013	Upper Aquifer								
OU1	BH69-13	6/21/2013	Upper Aquifer								
OU1	BH70-13	6/21/2013	Upper Aquifer								
OU1	BH71-13	6/20/2013	Upper Aquifer								
OU1	BH72-13	6/20/2013	Upper Aquifer								
OU1	BH73-13	6/20/2013	Upper Aquifer								
OU1	BH74-13	6/20/2013	Upper Aquifer								
OU1	BH75-13	6/25/2013	Upper Aquifer								
OU1	BH76-13	6/26/2013	Upper Aquifer	5	0	10	0	7	0	50	0
OU1	BH77-13	6/25/2013	Upper Aquifer								
OU1	BH78-13	6/25/2013	Upper Aquifer								
OU1	BH79-13	6/26/2013	Upper Aquifer								
OU1	BH80-13	6/25/2013	Upper Aquifer								
OU1	BH81-13	6/27/2013	Upper Aquifer	5	0	10	0	7	0	50	0
OU1	BH82-13	6/25/2013	Upper Aquifer								
OU1	BH83-13	6/25/2013	Upper Aquifer								
OU1	BH84-13	6/26/2013	Upper Aquifer								
OU1	BH85-13	6/25/2013	Upper Aquifer	5	0	10	0	7	0	50	0
OU1	BH86-13	6/24/2013	Upper Aquifer								
OU1	BH87-13	6/26/2013	Upper Aquifer								
OU1	BH88-13	6/24/2013	Upper Aquifer								
OU1	BH89-13	6/24/2013	Upper Aquifer	5	0	10	0	7	0	50	0
OU1	BH90-13	7/9/2013	Upper Aquifer								
OU1	BH91-13	6/28/2013	Upper Aquifer								
OU1	BH92-13	7/9/2013	Upper Aquifer								
OU1	BH93-13	7/9/2013	Upper Aquifer								
OU1	MW-101A	5/13/2015	Upper Aquifer								
OU1	MW-202	5/12/2015	Upper Aquifer								
OU1	MW-203	5/13/2015	Upper Aquifer								
OU1	MW-204	5/11/2015	Upper Aquifer								
OU1	MW-208	10/4/2017	Upper Aquifer	16	1	0.9	1	0.82	0	15	0
OU1	MW-209	5/12/2015	Upper Aquifer								
OU1	MW-209	10/17/2018	Upper Aquifer	0.89	0	0.2	0	1.8	1	15	0
OU1	MW-210	5/15/2015	Upper Aquifer								
OU1	MW-210	10/3/2017	Upper Aquifer								
OU1	MW-210	10/6/2017	Upper Aquifer	0.89	0	0.2	0	0.82	0	15	0
OU1	MW-212	5/12/2015	Upper Aquifer								
OU1	MW-212	10/17/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	15	0
OU1	MW-215A	5/13/2015	Upper Aquifer								
OU1	MW-217	10/17/2018	Upper Aquifer	1.3	1	0.21	1	0.82	0	15	0
OU1	MW-219	5/13/2015	Upper Aquifer								
OU1	MW-225	10/5/2017	Upper Aquifer	5.7	1	0.2	0	0.82	0	15	0
OU1	MW-227	10/4/2017	Upper Aquifer	0.89	0	0.63	1	0.82	0	15	0
OU1	MW-229	5/14/2015	Upper Aquifer								
OU1	MW-230	10/17/2018	Upper Aquifer	0.89	0	0.7	1	5.3	1	26	1
OU1	MW-233	10/18/2018	Upper Aquifer	1.8	1	0.2	0	0.82	0	15	0
OU1	MW-235	10/18/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	15	0
OU1	VAS-31	1/19/2018	Upper Aquifer	2.7	1	0.48	1	4.1	1	410	1
OU1	VAS-31	1/19/2018	Upper Aquifer	3	1	1.4	1	36	1	1100	1
OU1	VAS-31	1/22/2018	Upper Aquifer	1	1	0.2	1	0.82	0	290	1
OU1	VAS-31	1/22/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	330	1
OU1	VAS-32	1/8/2018	Upper Aquifer	2.5	1	1.2	1	41	1	1100	1
OU1	VAS-32	1/8/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	660	1
OU1	VAS-32	1/8/2018	Upper Aquifer	1.9	1	0.99	1	41	1	950	1
OU1	VAS-32	1/8/2018	Upper Aquifer	7.5	1	3.4	1	160	1	2300	1
OU1	VAS-33	1/10/2018	Upper Aquifer	0.89	0	0.2	0	1.5	1	870	1
OU1	VAS-33	1/10/2018	Upper Aquifer	11	1	1.7	1	150	1	5500	1

Table B.20.1

Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				68	69	70	71	72	73	74	75
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	Selenium	D_Selenium	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc
OU1	VAS-33	1/10/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	360	1
OU1	VAS-33	1/10/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	610	1
OU1	VAS-33	1/11/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	760	1
OU1	VAS-33	1/11/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	650	1
OU1	VAS-34	2/16/2018	Upper Aquifer	25	1	0.2	0	0.82	0	160	1
OU1	VAS-34	2/16/2018	Upper Aquifer	22	1	0.2	0	0.82	0	1300	1
OU1	VAS-34	2/19/2018	Upper Aquifer	4.9	1	0.2	1	14	1	4700	1
OU1	VAS-34	2/19/2018	Upper Aquifer	13	1	0.2	0	0.82	0	720	1
OU1	VAS-34	2/20/2018	Upper Aquifer	1	1	0.21	1	0.82	0	590	1
OU1	VAS-37	9/18/2018	Upper Aquifer	2.8	1	0.35	1	31	1	1200	1
OU1	VAS-38	2/7/2018	Upper Aquifer	1.6	1	0.4	1	14	1	360	1
OU1	VAS-38	2/7/2018	Upper Aquifer	3.1	1	0.58	1	37	1	560	1
OU1	VAS-38	2/7/2018	Upper Aquifer	0.89	0	0.2	0	5.2	1	360	1
OU1	VAS-38	2/7/2018	Upper Aquifer	0.89	0	0.2	0	3.5	1	300	1
OU1	VAS-38	2/8/2018	Upper Aquifer	0.89	0	0.2	0	2	1	210	1
OU1	VAS-38	2/8/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	190	1
OU1	VAS-38	2/8/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	180	1
OU1	VAS-38	2/9/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	280	1
OU1	VAS-44	1/25/2018	Upper Aquifer	6.6	1	0.62	1	22	1	3500	1
OU1	VAS-44	1/26/2018	Upper Aquifer	20	1	0.77	1	36	1	4300	1
OU1	VAS-44	1/29/2018	Upper Aquifer	1.3	1	0.2	0	1.2	1	200	1
OU1	VAS-44	1/29/2018	Upper Aquifer	0.89	0	0.2	0	2.8	1	460	1
OU1	VAS-44	1/29/2018	Upper Aquifer	0.89	0	0.2	0	0.82	0	260	1
OU1	VAS-44	1/30/2018	Upper Aquifer	0.89	0	0.2	0	1	1	140	1
OU1	MW-209A	5/13/2015	Lower Aquifer								
OU1	MW-209A	10/17/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	15	0
OU1	MW-210A	5/15/2015	Lower Aquifer								
OU1	MW-210A	10/3/2017	Lower Aquifer	0.89	0	0.2	0	0.82	0	15	0
OU1	MW-210B	5/15/2015	Lower Aquifer								
OU1	MW-210B	10/3/2017	Lower Aquifer	0.89	0	0.57	1	0.82	0	15	0
OU1	MW-215B	5/13/2015	Lower Aquifer								
OU1	MW-216	5/14/2015	Lower Aquifer								
OU1	VAS-15B	12/13/2017	Lower Aquifer	1.3		0.2		4.1		320	1
OU1	VAS-15B	12/13/2017	Lower Aquifer	0.89	0	0.2	0	0.82	0	510	1
OU1	VAS-15B	12/14/2017	Lower Aquifer	0.89	0	0.2	0	0.82	0	360	1
OU1	VAS-15B	12/14/2017	Lower Aquifer	0.89	0	0.2	0	0.82	0	420	1
OU1	VAS-15B	12/15/2017	Lower Aquifer	0.89	0	0.2	0	2.3	1	440	1
OU1	VAS-22b	9/25/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	860	1
OU1	VAS-22b	9/26/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	1500	1
OU1	VAS-22b	9/26/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	820	1
OU1	VAS-22b	9/27/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	700	1
OU1	VAS-22b	9/27/2018	Lower Aquifer	0.89	0	0.22	1	17	1	230	1
OU1	VAS-22b	9/27/2018	Lower Aquifer	0.89	0	0.2	0	2	1	130	1
OU1	VAS-22b	10/2/2018	Lower Aquifer	0.89	0	0.2	0	1.8	1	370	1
OU1	VAS-22b	10/2/2018	Lower Aquifer	0.89	0	0.2	0	13	1	310	0
OU1	VAS-22b	10/3/2018	Lower Aquifer	0.89	0	0.42	1	24	1	330	1
OU1	VAS-31	1/22/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	170	1
OU1	VAS-31	1/23/2018	Lower Aquifer	0.89	0	0.2	0	0.82	1	240	1
OU1	VAS-31	1/23/2018	Lower Aquifer	0.89	0	0.2	0	2.9	1	170	1
OU1	VAS-31	1/24/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	210	1
OU1	VAS-32	1/8/2018	Lower Aquifer	4.9	1	2.2	1	100	1	2600	1
OU1	VAS-32	1/9/2018	Lower Aquifer	1.2	1	0.33	1	12	1	1500	1
OU1	VAS-32	1/9/2018	Lower Aquifer	14	1	3	1	260	1	2300	1
OU1	VAS-32	1/9/2018	Lower Aquifer	2.4	1	0.65	1	51	1	1300	1
OU1	VAS-33	1/11/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	380	1
OU1	VAS-33	1/16/2018	Lower Aquifer	0.89	0	0.2	0	0.98	1	580	1
OU1	VAS-33	1/16/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	340	1
OU1	VAS-33	1/17/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	330	1
OU1	VAS-34	2/20/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	86	1
OU1	VAS-34	2/20/2018	Lower Aquifer	0.89	0	0.2	0	1.8	1	370	1
OU1	VAS-34	2/21/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	470	1
OU1	VAS-34	2/21/2018	Lower Aquifer	0.89	0	0.2	0	4.7	1	400	1
OU1	VAS-34	2/21/2018	Lower Aquifer	0.89	0	0.2	0	2.3	1	350	1
OU1	VAS-34	2/22/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	600	1
OU1	VAS-34	2/22/2018	Lower Aquifer	1	1	0.2	0	12	1	260	1
OU1	VAS-34	2/22/2018	Lower Aquifer	0.89	0	0.2	0	4.3	1	330	1

Table B.20.1

Summary of ProUCL Input Data for OU1 Groundwater (Upper Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				68	69	70	71	72	73	74	75
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	Selenium	D_Selenium	Thallium	D_Thallium	Vanadium	D_Vanadium	Zinc	D_Zinc
OU1	VAS-34	2/23/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	230	1
OU1	VAS-37	9/19/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	900	1
OU1	VAS-37	9/19/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	490	1
OU1	VAS-37	9/19/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	1300	1
OU1	VAS-37	9/20/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	2700	1
OU1	VAS-37	9/20/2018	Lower Aquifer	0.89	0	0.2	0	2.3	1	2500	1
OU1	VAS-37	9/21/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	1600	1
OU1	VAS-37	9/24/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	1600	1
OU1	VAS-37	9/24/2018	Lower Aquifer	0.89	0	0.25	1	9.4	1	2000	1
OU1	VAS-38	2/13/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	200	1
OU1	VAS-38	2/13/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	130	1
OU1	VAS-38	2/14/2018	Lower Aquifer	1.2	1	0.2	0	0.82	0	280	1
OU1	VAS-44	1/30/2018	Lower Aquifer	0.89	0	0.2	0	1.3	1	200	1
OU1	VAS-44	1/31/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	210	1
OU1	VAS-44	1/31/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	140	1
OU1	VAS-44	2/1/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	250	1
OU1	VAS-44	2/1/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	130	1
OU1	VAS-44	2/5/2018	Lower Aquifer	1	1	0.21	1	0.82	0	110	1
OU1	VAS-44	2/5/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	120	1
OU1	VAS-44	2/6/2018	Lower Aquifer	0.89	0	0.2	0	0.82	0	120	1

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	217	Number of Distinct Observations	57
		Number of Missing Observations	1
Number of Detects	50	Number of Non-Detects	167
Number of Distinct Detects	41	Number of Distinct Non-Detects	21
Minimum Detect	0.17	Minimum Non-Detect	0.17
Maximum Detect	23	Maximum Non-Detect	17
Variance Detects	13.49	Percent Non-Detects	76.96%
Mean Detects	1.46	SD Detects	3.673
Median Detects	0.46	CV Detects	2.516
Skewness Detects	4.957	Kurtosis Detects	26.38
Mean of Logged Detects	-0.5	SD of Logged Detects	1.037

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.36	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.363	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.125	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.511	KM Standard Error of Mean	0.126
KM SD	1.829	95% KM (BCA) UCL	0.739
95% KM (t) UCL	0.719	95% KM (Percentile Bootstrap) UCL	0.729
95% KM (z) UCL	0.718	95% KM Bootstrap t UCL	1.202
90% KM Chebyshev UCL	0.889	95% KM Chebyshev UCL	1.06
97.5% KM Chebyshev UCL	1.298	99% KM Chebyshev UCL	1.765

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.757	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.798	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.274	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.131	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.69	k star (bias corrected MLE)	0.662
Theta hat (MLE)	2.117	Theta star (bias corrected MLE)	2.207
nu hat (MLE)	68.95	nu star (bias corrected)	66.15
Mean (detects)	1.46		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.391
Maximum	23	Median	0.01
SD	1.865	CV	4.774
k hat (MLE)	0.276	k star (bias corrected MLE)	0.275
Theta hat (MLE)	1.417	Theta star (bias corrected MLE)	1.421
nu hat (MLE)	119.7	nu star (bias corrected)	119.3
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (119.34, α)	95.11	Adjusted Chi Square Value (119.34, β)	94.97
95% Gamma Approximate UCL (use when n>=50)	0.49	95% Gamma Adjusted UCL (use when n<50)	0.491

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.511	SD (KM)	1.829
Variance (KM)	3.345	SE of Mean (KM)	0.126
k hat (KM)	0.0779	k star (KM)	0.0799
nu hat (KM)	33.82	nu star (KM)	34.68
theta hat (KM)	6.552	theta star (KM)	6.388
80% gamma percentile (KM)	0.242	90% gamma percentile (KM)	1.21
95% gamma percentile (KM)	2.968	99% gamma percentile (KM)	9.046

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (34.68, α)	22.21	Adjusted Chi Square Value (34.68, β)	22.14
95% Gamma Approximate KM-UCL (use when n>=50)	0.797	95% Gamma Adjusted KM-UCL (use when n<50)	0.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.855	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.125	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.428	Mean in Log Scale	-2.221
SD in Original Scale	1.844	SD in Log Scale	1.47
95% t UCL (assumes normality of ROS data)	0.635	95% Percentile Bootstrap UCL	0.66
95% BCA Bootstrap UCL	0.777	95% Bootstrap t UCL	1.085
95% H-UCL (Log ROS)	0.414		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.34	KM Geo Mean	0.262
KM SD (logged)	0.751	95% Critical H Value (KM-Log)	1.957
KM Standard Error of Mean (logged)	0.0592	95% H-UCL (KM -Log)	0.384
KM SD (logged)	0.751	95% Critical H Value (KM-Log)	1.957
KM Standard Error of Mean (logged)	0.0592		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.77	Mean in Log Scale	-1.066
SD in Original Scale	2.03	SD in Log Scale	1.063
95% t UCL (Assumes normality)	0.998	95% H-Stat UCL	0.711

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1.06

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,2,4-Trichlorobenzene

General Statistics

Total Number of Observations	217	Number of Distinct Observations	23
		Number of Missing Observations	1
Number of Detects	1	Number of Non-Detects	216
Number of Distinct Detects	1	Number of Distinct Non-Detects	22

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,2,4-Trichlorobenzene was not processed!

1,2-Dibromo-3-chloropropane (DBCP)

General Statistics

Total Number of Observations	217	Number of Distinct Observations	14
		Number of Missing Observations	1
Number of Detects	1	Number of Non-Detects	216
Number of Distinct Detects	1	Number of Distinct Non-Detects	13

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,2-Dibromo-3-chloropropane (DBCP) was not processed!

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,2-Dichloroethane

General Statistics

Total Number of Observations	217	Number of Distinct Observations	24
		Number of Missing Observations	1
Number of Detects	2	Number of Non-Detects	215
Number of Distinct Detects	2	Number of Distinct Non-Detects	23
Minimum Detect	1.2	Minimum Non-Detect	0.21
Maximum Detect	2	Maximum Non-Detect	17
Variance Detects	0.32	Percent Non-Detects	99.08%
Mean Detects	1.6	SD Detects	0.566
Median Detects	1.6	CV Detects	0.354
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	0.438	SD of Logged Detects	0.361

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.224	KM Standard Error of Mean	0.0144
KM SD	0.144	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.248	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.248	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.267	95% KM Chebyshev UCL	0.287
97.5% KM Chebyshev UCL	0.314	99% KM Chebyshev UCL	0.368

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	15.66	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.102	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	62.64	nu star (bias corrected)	N/A
Mean (detects)	1.6		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.224	SD (KM)	0.144
Variance (KM)	0.0208	SE of Mean (KM)	0.0144
k hat (KM)	2.416	k star (KM)	2.386
nu hat (KM)	1049	nu star (KM)	1035
theta hat (KM)	0.0927	theta star (KM)	0.0939
80% gamma percentile (KM)	0.328	90% gamma percentile (KM)	0.418
95% gamma percentile (KM)	0.503	99% gamma percentile (KM)	0.689

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0489
Approximate Chi Square Value (N/A, α)	961.7	Adjusted Chi Square Value (N/A, β)	961.2
95% Gamma Approximate KM-UCL (use when n>=50)	0.241	95% Gamma Adjusted KM-UCL (use when n<50)	0.241

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0979	Mean in Log Scale	-3.074
SD in Original Scale	0.186	SD in Log Scale	1.201
95% t UCL (assumes normality of ROS data)	0.119	95% Percentile Bootstrap UCL	0.121
95% BCA Bootstrap UCL	0.127	95% Bootstrap t UCL	0.13
95% H-UCL (Log ROS)	0.115		

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,2-Dichloroethane (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.54	KM Geo Mean	0.214
KM SD (logged)	0.201	95% Critical H Value (KM-Log)	1.686
KM Standard Error of Mean (logged)	0.0202	95% H-UCL (KM -Log)	0.224
KM SD (logged)	0.201	95% Critical H Value (KM-Log)	1.686
KM Standard Error of Mean (logged)	0.0202		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.593	Mean in Log Scale	-1.101
SD in Original Scale	1.112	SD in Log Scale	0.919
95% t UCL (Assumes normality)	0.718	95% H-Stat UCL	0.578

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.248	KM H-UCL	0.224

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,4-Dichlorobenzene

General Statistics

Total Number of Observations	217	Number of Distinct Observations	35
		Number of Missing Observations	1
Number of Detects	14	Number of Non-Detects	203
Number of Distinct Detects	14	Number of Distinct Non-Detects	25
Minimum Detect	0.16	Minimum Non-Detect	0.16
Maximum Detect	5.6	Maximum Non-Detect	17
Variance Detects	2.14	Percent Non-Detects	93.55%
Mean Detects	1.006	SD Detects	1.463
Median Detects	0.445	CV Detects	1.455
Skewness Detects	2.791	Kurtosis Detects	8.251
Mean of Logged Detects	-0.567	SD of Logged Detects	0.99

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.589	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.349	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.228	KM Standard Error of Mean	0.031
KM SD	0.424	95% KM (BCA) UCL	0.286
95% KM (t) UCL	0.279	95% KM (Percentile Bootstrap) UCL	0.282
95% KM (z) UCL	0.279	95% KM Bootstrap t UCL	0.355
90% KM Chebyshev UCL	0.321	95% KM Chebyshev UCL	0.363
97.5% KM Chebyshev UCL	0.422	99% KM Chebyshev UCL	0.537

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.194	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.76	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.324	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.235	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.008	k star (bias corrected MLE)	0.839
Theta hat (MLE)	0.998	Theta star (bias corrected MLE)	1.198
nu hat (MLE)	28.21	nu star (bias corrected)	23.5
Mean (detects)	1.006		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0865
Maximum	5.6	Median	0.01
SD	0.444	CV	5.126
k hat (MLE)	0.368	k star (bias corrected MLE)	0.366
Theta hat (MLE)	0.235	Theta star (bias corrected MLE)	0.236
nu hat (MLE)	159.7	nu star (bias corrected)	158.8
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (158.84, α)	130.7	Adjusted Chi Square Value (158.84, β)	130.5
95% Gamma Approximate UCL (use when n>=50)	0.105	95% Gamma Adjusted UCL (use when n<50)	0.105

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,4-Dichlorobenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.228	SD (KM)	0.424
Variance (KM)	0.18	SE of Mean (KM)	0.031
k hat (KM)	0.289	k star (KM)	0.288
nu hat (KM)	125.5	nu star (KM)	125.1
theta hat (KM)	0.789	theta star (KM)	0.792
80% gamma percentile (KM)	0.346	90% gamma percentile (KM)	0.676
95% gamma percentile (KM)	1.058	99% gamma percentile (KM)	2.053

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (125.10, α)	100.3	Adjusted Chi Square Value (125.10, β)	100.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.285	95% Gamma Adjusted KM-UCL (use when n<50)	0.285

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.265	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.105	Mean in Log Scale	-3.92
SD in Original Scale	0.437	SD in Log Scale	1.731
95% t UCL (assumes normality of ROS data)	0.154	95% Percentile Bootstrap UCL	0.158
95% BCA Bootstrap UCL	0.181	95% Bootstrap t UCL	0.241
95% H-UCL (Log ROS)	0.124		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.704	KM Geo Mean	0.182
KM SD (logged)	0.436	95% Critical H Value (KM-Log)	1.773
KM Standard Error of Mean (logged)	0.037	95% H-UCL (KM -Log)	0.211
KM SD (logged)	0.436	95% Critical H Value (KM-Log)	1.773
KM Standard Error of Mean (logged)	0.037		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.578	Mean in Log Scale	-1.214
SD in Original Scale	1.076	SD in Log Scale	1.034
95% t UCL (Assumes normality)	0.698	95% H-Stat UCL	0.591

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.211

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene

General Statistics

Total Number of Observations	217	Number of Distinct Observations	54
		Number of Missing Observations	1
Number of Detects	44	Number of Non-Detects	173
Number of Distinct Detects	39	Number of Distinct Non-Detects	21
Minimum Detect	0.15	Minimum Non-Detect	0.13
Maximum Detect	390	Maximum Non-Detect	17
Variance Detects	3726	Percent Non-Detects	79.72%
Mean Detects	13.88	SD Detects	61.04
Median Detects	0.49	CV Detects	4.399
Skewness Detects	5.789	Kurtosis Detects	35.47
Mean of Logged Detects	-0.256	SD of Logged Detects	1.69

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.252	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.471	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.132	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.971	KM Standard Error of Mean	1.904
KM SD	27.72	95% KM (BCA) UCL	7
95% KM (t) UCL	6.116	95% KM (Percentile Bootstrap) UCL	6.582
95% KM (z) UCL	6.102	95% KM Bootstrap t UCL	50.51
90% KM Chebyshev UCL	8.682	95% KM Chebyshev UCL	11.27
97.5% KM Chebyshev UCL	14.86	99% KM Chebyshev UCL	21.91

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	10.12	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.888	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.425	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.147	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.247	k star (bias corrected MLE)	0.245
Theta hat (MLE)	56.27	Theta star (bias corrected MLE)	56.65
nu hat (MLE)	21.7	nu star (bias corrected)	21.56
Mean (detects)	13.88		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.322
Maximum	390	Median	0.01
SD	27.96	CV	8.417
k hat (MLE)	0.162	k star (bias corrected MLE)	0.163
Theta hat (MLE)	20.54	Theta star (bias corrected MLE)	20.43
nu hat (MLE)	70.2	nu star (bias corrected)	70.56
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (70.56, α)	52.22	Adjusted Chi Square Value (70.56, β)	52.11
95% Gamma Approximate UCL (use when n>=50)	4.488	95% Gamma Adjusted UCL (use when n<50)	4.497

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.971	SD (KM)	27.72
Variance (KM)	768.6	SE of Mean (KM)	1.904
k hat (KM)	0.0115	k star (KM)	0.0144
nu hat (KM)	4.983	nu star (KM)	6.247
theta hat (KM)	258.7	theta star (KM)	206.4
80% gamma percentile (KM)	2.1703E-5	90% gamma percentile (KM)	0.0777
95% gamma percentile (KM)	3.377	99% gamma percentile (KM)	83.97

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.25, α)	1.767	Adjusted Chi Square Value (6.25, β)	1.752
95% Gamma Approximate KM-UCL (use when n>=50)	10.5	95% Gamma Adjusted KM-UCL (use when n<50)	10.59

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.713	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.944	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.132	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.904	Mean in Log Scale	-2.959
SD in Original Scale	27.8	SD in Log Scale	2.238
95% t UCL (assumes normality of ROS data)	6.021	95% Percentile Bootstrap UCL	6.635
95% BCA Bootstrap UCL	9.05	95% Bootstrap t UCL	48.75
95% H-UCL (Log ROS)	1.072		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.469	KM Geo Mean	0.23
KM SD (logged)	1.055	95% Critical H Value (KM-Log)	2.194
KM Standard Error of Mean (logged)	0.0839	95% H-UCL (KM -Log)	0.47
KM SD (logged)	1.055	95% Critical H Value (KM-Log)	2.194
KM Standard Error of Mean (logged)	0.0839		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.228	Mean in Log Scale	-1.053
SD in Original Scale	27.78	SD in Log Scale	1.226
95% t UCL (Assumes normality)	6.343	95% H-Stat UCL	0.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	11.27

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Bromodichloromethane

General Statistics

Total Number of Observations	217	Number of Distinct Observations	29
		Number of Missing Observations	1
Number of Detects	6	Number of Non-Detects	211
Number of Distinct Detects	6	Number of Distinct Non-Detects	24
Minimum Detect	0.34	Minimum Non-Detect	0.17
Maximum Detect	1.1	Maximum Non-Detect	17
Variance Detects	0.0801	Percent Non-Detects	97.24%
Mean Detects	0.587	SD Detects	0.283
Median Detects	0.51	CV Detects	0.482
Skewness Detects	1.444	Kurtosis Detects	2.043
Mean of Logged Detects	-0.618	SD of Logged Detects	0.438

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.857	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.191	KM Standard Error of Mean	0.00992
KM SD	0.1	95% KM (BCA) UCL	0.209
95% KM (t) UCL	0.208	95% KM (Percentile Bootstrap) UCL	0.207
95% KM (z) UCL	0.208	95% KM Bootstrap t UCL	0.204
90% KM Chebyshev UCL	0.221	95% KM Chebyshev UCL	0.235
97.5% KM Chebyshev UCL	0.253	99% KM Chebyshev UCL	0.29

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.337	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.054	k star (bias corrected MLE)	3.138
Theta hat (MLE)	0.0969	Theta star (bias corrected MLE)	0.187
nu hat (MLE)	72.65	nu star (bias corrected)	37.66
Mean (detects)	0.587		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0421
Maximum	1.1	Median	0.01
SD	0.124	CV	2.942
k hat (MLE)	0.565	k star (bias corrected MLE)	0.56
Theta hat (MLE)	0.0746	Theta star (bias corrected MLE)	0.0752
nu hat (MLE)	245.3	nu star (bias corrected)	243.2
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (243.21, α)	208.1	Adjusted Chi Square Value (243.21, β)	207.9
95% Gamma Approximate UCL (use when n>=50)	0.0492	95% Gamma Adjusted UCL (use when n<50)	0.0493

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Bromodichloromethane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.191	SD (KM)	0.1
Variance (KM)	0.0101	SE of Mean (KM)	0.00992
k hat (KM)	3.638	k star (KM)	3.591
nu hat (KM)	1579	nu star (KM)	1558
theta hat (KM)	0.0526	theta star (KM)	0.0533
80% gamma percentile (KM)	0.267	90% gamma percentile (KM)	0.327
95% gamma percentile (KM)	0.382	99% gamma percentile (KM)	0.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	1468	Adjusted Chi Square Value (N/A, β)	1467
95% Gamma Approximate KM-UCL (use when n>=50)	0.203	95% Gamma Adjusted KM-UCL (use when n<50)	0.203

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.199	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.104	Mean in Log Scale	-2.683
SD in Original Scale	0.123	SD in Log Scale	0.901
95% t UCL (assumes normality of ROS data)	0.118	95% Percentile Bootstrap UCL	0.119
95% BCA Bootstrap UCL	0.12	95% Bootstrap t UCL	0.121
95% H-UCL (Log ROS)	0.116		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.709	KM Geo Mean	0.181
KM SD (logged)	0.267	95% Critical H Value (KM-Log)	1.706
KM Standard Error of Mean (logged)	0.0281	95% H-UCL (KM -Log)	0.194
KM SD (logged)	0.267	95% Critical H Value (KM-Log)	1.706
KM Standard Error of Mean (logged)	0.0281		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.594	Mean in Log Scale	-1.093
SD in Original Scale	1.078	SD in Log Scale	0.936
95% t UCL (Assumes normality)	0.715	95% H-Stat UCL	0.593

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.208

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chlorobenzene

General Statistics

Total Number of Observations	217	Number of Distinct Observations	54
		Number of Missing Observations	1
Number of Detects	43	Number of Non-Detects	174
Number of Distinct Detects	34	Number of Distinct Non-Detects	23
Minimum Detect	0.2	Minimum Non-Detect	0.14
Maximum Detect	40	Maximum Non-Detect	17
Variance Detects	44.18	Percent Non-Detects	80.18%
Mean Detects	3.615	SD Detects	6.647
Median Detects	1.4	CV Detects	1.839
Skewness Detects	4.34	Kurtosis Detects	22.1
Mean of Logged Detects	0.431	SD of Logged Detects	1.27

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.513	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.943	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.304	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.134	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.878	KM Standard Error of Mean	0.223
KM SD	3.238	95% KM (BCA) UCL	1.307
95% KM (t) UCL	1.247	95% KM (Percentile Bootstrap) UCL	1.278
95% KM (z) UCL	1.245	95% KM Bootstrap t UCL	1.616
90% KM Chebyshev UCL	1.548	95% KM Chebyshev UCL	1.851
97.5% KM Chebyshev UCL	2.273	99% KM Chebyshev UCL	3.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.464	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.794	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.14	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.141	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.707	k star (bias corrected MLE)	0.673
Theta hat (MLE)	5.114	Theta star (bias corrected MLE)	5.371
nu hat (MLE)	60.78	nu star (bias corrected)	57.88
Mean (detects)	3.615		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.73
Maximum	40	Median	0.01
SD	3.265	CV	4.473
k hat (MLE)	0.222	k star (bias corrected MLE)	0.222
Theta hat (MLE)	3.283	Theta star (bias corrected MLE)	3.283
nu hat (MLE)	96.5	nu star (bias corrected)	96.5
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (96.50, α)	74.84	Adjusted Chi Square Value (96.50, β)	74.71
95% Gamma Approximate UCL (use when n>=50)	0.941	95% Gamma Adjusted UCL (use when n<50)	0.943

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chlorobenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.878	SD (KM)	3.238
Variance (KM)	10.49	SE of Mean (KM)	0.223
k hat (KM)	0.0735	k star (KM)	0.0755
nu hat (KM)	31.88	nu star (KM)	32.77
theta hat (KM)	11.95	theta star (KM)	11.62
80% gamma percentile (KM)	0.372	90% gamma percentile (KM)	2.003
95% gamma percentile (KM)	5.085	99% gamma percentile (KM)	15.97

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (32.77, α)	20.69	Adjusted Chi Square Value (32.77, β)	20.62
95% Gamma Approximate KM-UCL (use when n>=50)	1.39	95% Gamma Adjusted KM-UCL (use when n<50)	1.395

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.943	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.112	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.134	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.787	Mean in Log Scale	-2.662
SD in Original Scale	3.254	SD in Log Scale	2.195
95% t UCL (assumes normality of ROS data)	1.152	95% Percentile Bootstrap UCL	1.184
95% BCA Bootstrap UCL	1.371	95% Bootstrap t UCL	1.554
95% H-UCL (Log ROS)	1.286		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.354	KM Geo Mean	0.258
KM SD (logged)	1.122	95% Critical H Value (KM-Log)	2.253
KM Standard Error of Mean (logged)	0.087	95% H-UCL (KM -Log)	0.576
KM SD (logged)	1.122	95% Critical H Value (KM-Log)	2.253
KM Standard Error of Mean (logged)	0.087		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.195	Mean in Log Scale	-0.863
SD in Original Scale	3.334	SD in Log Scale	1.241
95% t UCL (Assumes normality)	1.569	95% H-Stat UCL	1.112

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	1.39

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane)

General Statistics

Total Number of Observations	217	Number of Distinct Observations	42
		Number of Missing Observations	1
Number of Detects	24	Number of Non-Detects	193
Number of Distinct Detects	19	Number of Distinct Non-Detects	25
Minimum Detect	0.13	Minimum Non-Detect	0.13
Maximum Detect	1.8	Maximum Non-Detect	17
Variance Detects	0.254	Percent Non-Detects	88.94%
Mean Detects	0.618	SD Detects	0.504
Median Detects	0.435	CV Detects	0.816
Skewness Detects	1.195	Kurtosis Detects	0.234
Mean of Logged Detects	-0.783	SD of Logged Detects	0.796

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.823	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.916	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.223	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.177	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.244	KM Standard Error of Mean	0.023
KM SD	0.245	95% KM (BCA) UCL	0.28
95% KM (t) UCL	0.282	95% KM (Percentile Bootstrap) UCL	0.282
95% KM (z) UCL	0.281	95% KM Bootstrap t UCL	0.289
90% KM Chebyshev UCL	0.313	95% KM Chebyshev UCL	0.344
97.5% KM Chebyshev UCL	0.387	99% KM Chebyshev UCL	0.472

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.656	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.758	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.137	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.181	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.802	k star (bias corrected MLE)	1.605
Theta hat (MLE)	0.343	Theta star (bias corrected MLE)	0.385
nu hat (MLE)	86.51	nu star (bias corrected)	77.03
Mean (detects)	0.618		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.158
Maximum	1.8	Median	0.01
SD	0.282	CV	1.785
k hat (MLE)	0.465	k star (bias corrected MLE)	0.462
Theta hat (MLE)	0.339	Theta star (bias corrected MLE)	0.342
nu hat (MLE)	201.8	nu star (bias corrected)	200.3
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (200.33, α)	168.6	Adjusted Chi Square Value (200.33, β)	168.4
95% Gamma Approximate UCL (use when n>=50)	0.188	95% Gamma Adjusted UCL (use when n<50)	0.188

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.244	SD (KM)	0.245
Variance (KM)	0.0599	SE of Mean (KM)	0.023
k hat (KM)	0.992	k star (KM)	0.982
nu hat (KM)	430.6	nu star (KM)	426
theta hat (KM)	0.246	theta star (KM)	0.248
80% gamma percentile (KM)	0.393	90% gamma percentile (KM)	0.564
95% gamma percentile (KM)	0.735	99% gamma percentile (KM)	1.133

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (425.97, α)	379.1	Adjusted Chi Square Value (425.97, β)	378.8
95% Gamma Approximate KM-UCL (use when n>=50)	0.274	95% Gamma Adjusted KM-UCL (use when n<50)	0.274

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.95	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.916	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.121	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.177	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.205	Mean in Log Scale	-2.015
SD in Original Scale	0.25	SD in Log Scale	0.905
95% t UCL (assumes normality of ROS data)	0.233	95% Percentile Bootstrap UCL	0.237
95% BCA Bootstrap UCL	0.237	95% Bootstrap t UCL	0.241
95% H-UCL (Log ROS)	0.228		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.636	KM Geo Mean	0.195
KM SD (logged)	0.568	95% Critical H Value (KM-Log)	1.841
KM Standard Error of Mean (logged)	0.0784	95% H-UCL (KM -Log)	0.246
KM SD (logged)	0.568	95% Critical H Value (KM-Log)	1.841
KM Standard Error of Mean (logged)	0.0784		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.627	Mean in Log Scale	-0.997
SD in Original Scale	1.064	SD in Log Scale	0.91
95% t UCL (Assumes normality)	0.746	95% H-Stat UCL	0.634

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.274	95% GROS Approximate Gamma UCL	0.188

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

cis-1,2-Dichloroethene

General Statistics

Total Number of Observations	217	Number of Distinct Observations	101
		Number of Missing Observations	1
Number of Detects	147	Number of Non-Detects	70
Number of Distinct Detects	98	Number of Distinct Non-Detects	7
Minimum Detect	0.17	Minimum Non-Detect	0.16
Maximum Detect	1100	Maximum Non-Detect	14
Variance Detects	12012	Percent Non-Detects	32.26%
Mean Detects	27.21	SD Detects	109.6
Median Detects	2.8	CV Detects	4.029
Skewness Detects	7.692	Kurtosis Detects	67.55
Mean of Logged Detects	1.345	SD of Logged Detects	1.741

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.267	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.403	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0735	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	18.54	KM Standard Error of Mean	6.183
KM SD	90.77	95% KM (BCA) UCL	29.75
95% KM (t) UCL	28.75	95% KM (Percentile Bootstrap) UCL	29.91
95% KM (z) UCL	28.71	95% KM Bootstrap t UCL	41.37
90% KM Chebyshev UCL	37.09	95% KM Chebyshev UCL	45.49
97.5% KM Chebyshev UCL	57.15	99% KM Chebyshev UCL	80.06

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	12.68	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.858	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.214	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0835	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.344	k star (bias corrected MLE)	0.342
Theta hat (MLE)	79.03	Theta star (bias corrected MLE)	79.61
nu hat (MLE)	101.2	nu star (bias corrected)	100.5
Mean (detects)	27.21		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	18.43
Maximum	1100	Median	1
SD	91	CV	4.937
k hat (MLE)	0.209	k star (bias corrected MLE)	0.21
Theta hat (MLE)	88.01	Theta star (bias corrected MLE)	87.94
nu hat (MLE)	90.89	nu star (bias corrected)	90.97
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (90.97, α)	69.98	Adjusted Chi Square Value (90.97, β)	69.85
95% Gamma Approximate UCL (use when n>=50)	23.96	95% Gamma Adjusted UCL (use when n<50)	24

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

cis-1,2-Dichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	18.54	SD (KM)	90.77
Variance (KM)	8240	SE of Mean (KM)	6.183
k hat (KM)	0.0417	k star (KM)	0.0442
nu hat (KM)	18.1	nu star (KM)	19.19
theta hat (KM)	444.4	theta star (KM)	419.4
80% gamma percentile (KM)	1.573	90% gamma percentile (KM)	23.75
95% gamma percentile (KM)	93.7	99% gamma percentile (KM)	422.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (19.19, α)	10.25	Adjusted Chi Square Value (19.19, β)	10.21
95% Gamma Approximate KM-UCL (use when n>=50)	34.69	95% Gamma Adjusted KM-UCL (use when n<50)	34.84

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.947	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	2.6633E-5	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0912	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0735	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	18.51	Mean in Log Scale	0.215
SD in Original Scale	90.99	SD in Log Scale	2.303
95% t UCL (assumes normality of ROS data)	28.71	95% Percentile Bootstrap UCL	29.26
95% BCA Bootstrap UCL	36.9	95% Bootstrap t UCL	42.46
95% H-UCL (Log ROS)	30.45		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.466	KM Geo Mean	1.594
KM SD (logged)	1.951	95% Critical H Value (KM-Log)	3.104
KM Standard Error of Mean (logged)	0.136	95% H-UCL (KM -Log)	16.14
KM SD (logged)	1.951	95% Critical H Value (KM-Log)	3.104
KM Standard Error of Mean (logged)	0.136		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	18.57	Mean in Log Scale	0.506
SD in Original Scale	90.98	SD in Log Scale	1.944
95% t UCL (Assumes normality)	28.78	95% H-Stat UCL	16.53

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	45.49

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene

General Statistics

Total Number of Observations	217	Number of Distinct Observations	38
		Number of Missing Observations	1
Number of Detects	19	Number of Non-Detects	198
Number of Distinct Detects	18	Number of Distinct Non-Detects	22
Minimum Detect	0.13	Minimum Non-Detect	0.11
Maximum Detect	100	Maximum Non-Detect	17
Variance Detects	517.2	Percent Non-Detects	91.24%
Mean Detects	6.562	SD Detects	22.74
Median Detects	0.59	CV Detects	3.466
Skewness Detects	4.288	Kurtosis Detects	18.55
Mean of Logged Detects	-0.104	SD of Logged Detects	1.519

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.3	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.901	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.431	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.197	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.702	KM Standard Error of Mean	0.474
KM SD	6.799	95% KM (BCA) UCL	1.626
95% KM (t) UCL	1.486	95% KM (Percentile Bootstrap) UCL	1.615
95% KM (z) UCL	1.482	95% KM Bootstrap t UCL	10.39
90% KM Chebyshev UCL	2.125	95% KM Chebyshev UCL	2.77
97.5% KM Chebyshev UCL	3.664	99% KM Chebyshev UCL	5.421

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.517	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.835	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.361	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.214	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.34	k star (bias corrected MLE)	0.322
Theta hat (MLE)	19.28	Theta star (bias corrected MLE)	20.4
nu hat (MLE)	12.93	nu star (bias corrected)	12.22
Mean (detects)	6.562		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.654
Maximum	100	Median	0.01
SD	6.851	CV	10.47
k hat (MLE)	0.199	k star (bias corrected MLE)	0.199
Theta hat (MLE)	3.289	Theta star (bias corrected MLE)	3.283
nu hat (MLE)	86.32	nu star (bias corrected)	86.46
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (86.46, α)	66.03	Adjusted Chi Square Value (86.46, β)	65.91
95% Gamma Approximate UCL (use when n>=50)	0.857	95% Gamma Adjusted UCL (use when n<50)	0.858

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.702	SD (KM)	6.799
Variance (KM)	46.22	SE of Mean (KM)	0.474
k hat (KM)	0.0107	k star (KM)	0.0136
nu hat (KM)	4.626	nu star (KM)	5.896
theta hat (KM)	65.85	theta star (KM)	51.67
80% gamma percentile (KM)	2.1561E-6	90% gamma percentile (KM)	0.0126
95% gamma percentile (KM)	0.681	99% gamma percentile (KM)	19.76

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.90, α)	1.587	Adjusted Chi Square Value (5.90, β)	1.572
95% Gamma Approximate KM-UCL (use when n>=50)	2.608	95% Gamma Adjusted KM-UCL (use when n<50)	2.632

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.901	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.197	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.614	Mean in Log Scale	-4.711
SD in Original Scale	6.821	SD in Log Scale	2.587
95% t UCL (assumes normality of ROS data)	1.379	95% Percentile Bootstrap UCL	1.519
95% BCA Bootstrap UCL	2.075	95% Bootstrap t UCL	11.48
95% H-UCL (Log ROS)	0.503		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.926	KM Geo Mean	0.146
KM SD (logged)	0.804	95% Critical H Value (KM-Log)	1.995
KM Standard Error of Mean (logged)	0.0661	95% H-UCL (KM -Log)	0.224
KM SD (logged)	0.804	95% Critical H Value (KM-Log)	1.995
KM Standard Error of Mean (logged)	0.0661		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.05	Mean in Log Scale	-1.178
SD in Original Scale	6.848	SD in Log Scale	1.126
95% t UCL (Assumes normality)	1.818	95% H-Stat UCL	0.69

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	2.77

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Methylene chloride

General Statistics

Total Number of Observations	217	Number of Distinct Observations	30
		Number of Missing Observations	1
Number of Detects	3	Number of Non-Detects	214
Number of Distinct Detects	3	Number of Distinct Non-Detects	28
Minimum Detect	2	Minimum Non-Detect	0.53
Maximum Detect	15	Maximum Non-Detect	170
Variance Detects	42.81	Percent Non-Detects	98.62%
Mean Detects	8.933	SD Detects	6.543
Median Detects	9.8	CV Detects	0.732
Skewness Detects	-0.586	Kurtosis Detects	N/A
Mean of Logged Detects	1.895	SD of Logged Detects	1.062

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.987	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.652	KM Standard Error of Mean	0.1
KM SD	1.184	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.817	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.817	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.952	95% KM Chebyshev UCL	1.088
97.5% KM Chebyshev UCL	1.277	99% KM Chebyshev UCL	1.648

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.843	k star (bias corrected MLE)	N/A
Theta hat (MLE)	4.848	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	11.06	nu star (bias corrected)	N/A
Mean (detects)	8.933		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.133
Maximum	15	Median	0.01
SD	1.219	CV	9.144
k hat (MLE)	0.279	k star (bias corrected MLE)	0.278
Theta hat (MLE)	0.478	Theta star (bias corrected MLE)	0.479
nu hat (MLE)	121.1	nu star (bias corrected)	120.8
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (120.76, α)	96.38	Adjusted Chi Square Value (120.76, β)	96.24
95% Gamma Approximate UCL (use when n>=50)	0.167	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Methylene chloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.652	SD (KM)	1.184
Variance (KM)	1.403	SE of Mean (KM)	0.1
k hat (KM)	0.303	k star (KM)	0.302
nu hat (KM)	131.5	nu star (KM)	131
theta hat (KM)	2.152	theta star (KM)	2.16
80% gamma percentile (KM)	1.001	90% gamma percentile (KM)	1.921
95% gamma percentile (KM)	2.976	99% gamma percentile (KM)	5.716

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (131.00, α)	105.6	Adjusted Chi Square Value (131.00, β)	105.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.809	95% Gamma Adjusted KM-UCL (use when n<50)	0.81

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.309	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.161	Mean in Log Scale	-6.035
SD in Original Scale	1.223	SD in Log Scale	2.84
95% t UCL (assumes normality of ROS data)	0.298	95% Percentile Bootstrap UCL	0.303
95% BCA Bootstrap UCL	0.395	95% Bootstrap t UCL	1.077
95% H-UCL (Log ROS)	0.301		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.597	KM Geo Mean	0.55
KM SD (logged)	0.321	95% Critical H Value (KM-Log)	1.725
KM Standard Error of Mean (logged)	0.0275	95% H-UCL (KM -Log)	0.602
KM SD (logged)	0.321	95% Critical H Value (KM-Log)	1.725
KM Standard Error of Mean (logged)	0.0275		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.45	Mean in Log Scale	-0.524
SD in Original Scale	6.095	SD in Log Scale	0.926
95% t UCL (Assumes normality)	2.133	95% H-Stat UCL	1.036

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.817

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Toluene

General Statistics

Total Number of Observations	217	Number of Distinct Observations	70
		Number of Missing Observations	1
Number of Detects	85	Number of Non-Detects	132
Number of Distinct Detects	55	Number of Distinct Non-Detects	23
Minimum Detect	0.13	Minimum Non-Detect	0.14
Maximum Detect	270	Maximum Non-Detect	17
Variance Detects	933.5	Percent Non-Detects	60.83%
Mean Detects	5.502	SD Detects	30.55
Median Detects	0.41	CV Detects	5.553
Skewness Detects	8.105	Kurtosis Detects	69.21
Mean of Logged Detects	-0.517	SD of Logged Detects	1.429

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.188	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.436	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0962	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.296	KM Standard Error of Mean	1.31
KM SD	19.18	95% KM (BCA) UCL	5.075
95% KM (t) UCL	4.46	95% KM (Percentile Bootstrap) UCL	4.692
95% KM (z) UCL	4.451	95% KM Bootstrap t UCL	16.78
90% KM Chebyshev UCL	6.226	95% KM Chebyshev UCL	8.007
97.5% KM Chebyshev UCL	10.48	99% KM Chebyshev UCL	15.33

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	15.52	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.864	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.317	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.105	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.309	k star (bias corrected MLE)	0.306
Theta hat (MLE)	17.81	Theta star (bias corrected MLE)	17.99
nu hat (MLE)	52.51	nu star (bias corrected)	51.99
Mean (detects)	5.502		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.306
Maximum	270	Median	0.01
SD	19.25	CV	8.348
k hat (MLE)	0.201	k star (bias corrected MLE)	0.202
Theta hat (MLE)	11.46	Theta star (bias corrected MLE)	11.44
nu hat (MLE)	87.33	nu star (bias corrected)	87.46
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (87.46, α)	66.9	Adjusted Chi Square Value (87.46, β)	66.78
95% Gamma Approximate UCL (use when n>=50)	3.014	95% Gamma Adjusted UCL (use when n<50)	3.02

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Toluene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.296	SD (KM)	19.18
Variance (KM)	368	SE of Mean (KM)	1.31
k hat (KM)	0.0143	k star (KM)	0.0172
nu hat (KM)	6.216	nu star (KM)	7.464
theta hat (KM)	160.3	theta star (KM)	133.5
80% gamma percentile (KM)	1.7606E-4	90% gamma percentile (KM)	0.166
95% gamma percentile (KM)	3.964	99% gamma percentile (KM)	64.94

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.46, α)	2.428	Adjusted Chi Square Value (7.46, β)	2.409
95% Gamma Approximate KM-UCL (use when n>=50)	7.056	95% Gamma Adjusted KM-UCL (use when n<50)	7.112

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.824	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.865E-14	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.175	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0962	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.269	Mean in Log Scale	-1.563
SD in Original Scale	19.23	SD in Log Scale	1.505
95% t UCL (assumes normality of ROS data)	4.425	95% Percentile Bootstrap UCL	4.599
95% BCA Bootstrap UCL	6.85	95% Bootstrap t UCL	22.84
95% H-UCL (Log ROS)	0.85		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.208	KM Geo Mean	0.299
KM SD (logged)	1.119	95% Critical H Value (KM-Log)	2.251
KM Standard Error of Mean (logged)	0.0831	95% H-UCL (KM -Log)	0.663
KM SD (logged)	1.119	95% Critical H Value (KM-Log)	2.251
KM Standard Error of Mean (logged)	0.0831		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.535	Mean in Log Scale	-0.901
SD in Original Scale	19.22	SD in Log Scale	1.25
95% t UCL (Assumes normality)	4.691	95% H-Stat UCL	1.085

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	8.007

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	217	Number of Distinct Observations	75
		Number of Missing Observations	1
Number of Detects	76	Number of Non-Detects	141
Number of Distinct Detects	59	Number of Distinct Non-Detects	20
Minimum Detect	0.17	Minimum Non-Detect	0.1
Maximum Detect	94	Maximum Non-Detect	17
Variance Detects	506.6	Percent Non-Detects	64.98%
Mean Detects	11.11	SD Detects	22.51
Median Detects	1.85	CV Detects	2.025
Skewness Detects	2.478	Kurtosis Detects	5.06
Mean of Logged Detects	0.898	SD of Logged Detects	1.66

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.526	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.36	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.102	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.03	KM Standard Error of Mean	0.972
KM SD	14.22	95% KM (BCA) UCL	5.588
95% KM (t) UCL	5.636	95% KM (Percentile Bootstrap) UCL	5.641
95% KM (z) UCL	5.629	95% KM Bootstrap t UCL	6.178
90% KM Chebyshev UCL	6.947	95% KM Chebyshev UCL	8.268
97.5% KM Chebyshev UCL	10.1	99% KM Chebyshev UCL	13.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.072	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.834	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.109	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.431	k star (bias corrected MLE)	0.422
Theta hat (MLE)	25.8	Theta star (bias corrected MLE)	26.3
nu hat (MLE)	65.46	nu star (bias corrected)	64.21
Mean (detects)	11.11		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.898
Maximum	94	Median	0.01
SD	14.29	CV	3.664
k hat (MLE)	0.185	k star (bias corrected MLE)	0.185
Theta hat (MLE)	21.13	Theta star (bias corrected MLE)	21.07
nu hat (MLE)	80.08	nu star (bias corrected)	80.31
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (80.31, α)	60.66	Adjusted Chi Square Value (80.31, β)	60.55
95% Gamma Approximate UCL (use when n>=50)	5.161	95% Gamma Adjusted UCL (use when n<50)	5.171

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.03	SD (KM)	14.22
Variance (KM)	202.2	SE of Mean (KM)	0.972
k hat (KM)	0.0803	k star (KM)	0.0823
nu hat (KM)	34.86	nu star (KM)	35.71
theta hat (KM)	50.18	theta star (KM)	48.98
80% gamma percentile (KM)	2.024	90% gamma percentile (KM)	9.723
95% gamma percentile (KM)	23.46	99% gamma percentile (KM)	70.43

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (35.71, α)	23.04	Adjusted Chi Square Value (35.71, β)	22.97
95% Gamma Approximate KM-UCL (use when n>=50)	6.248	95% Gamma Adjusted KM-UCL (use when n<50)	6.266

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.915	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	2.4187E-5	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.116	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.102	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.962	Mean in Log Scale	-1.835
SD in Original Scale	14.27	SD in Log Scale	2.639
95% t UCL (assumes normality of ROS data)	5.562	95% Percentile Bootstrap UCL	5.578
95% BCA Bootstrap UCL	5.975	95% Bootstrap t UCL	6.024
95% H-UCL (Log ROS)	10.49		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.966	KM Geo Mean	0.38
KM SD (logged)	1.771	95% Critical H Value (KM-Log)	2.905
KM Standard Error of Mean (logged)	0.131	95% H-UCL (KM -Log)	2.592
KM SD (logged)	1.771	95% Critical H Value (KM-Log)	2.905
KM Standard Error of Mean (logged)	0.131		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.32	Mean in Log Scale	-0.491
SD in Original Scale	14.21	SD in Log Scale	1.692
95% t UCL (Assumes normality)	5.914	95% H-Stat UCL	3.546

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	8.268

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride

General Statistics

Total Number of Observations	217	Number of Distinct Observations	83
		Number of Missing Observations	1
Number of Detects	102	Number of Non-Detects	115
Number of Distinct Detects	77	Number of Distinct Non-Detects	13
Minimum Detect	0.25	Minimum Non-Detect	0.2
Maximum Detect	620	Maximum Non-Detect	14
Variance Detects	7940	Percent Non-Detects	53%
Mean Detects	31.14	SD Detects	89.11
Median Detects	3.6	CV Detects	2.862
Skewness Detects	4.536	Kurtosis Detects	22.96
Mean of Logged Detects	1.579	SD of Logged Detects	1.81

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.392	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.364	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.088	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	14.81	KM Standard Error of Mean	4.278
KM SD	62.71	95% KM (BCA) UCL	22.04
95% KM (t) UCL	21.88	95% KM (Percentile Bootstrap) UCL	22.14
95% KM (z) UCL	21.85	95% KM Bootstrap t UCL	26.33
90% KM Chebyshev UCL	27.65	95% KM Chebyshev UCL	33.46
97.5% KM Chebyshev UCL	41.53	99% KM Chebyshev UCL	57.38

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	7.932	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.853	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0958	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.36	k star (bias corrected MLE)	0.356
Theta hat (MLE)	86.5	Theta star (bias corrected MLE)	87.48
nu hat (MLE)	73.44	nu star (bias corrected)	72.61
Mean (detects)	31.14		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	14.64
Maximum	620	Median	0.01
SD	62.89	CV	4.295
k hat (MLE)	0.172	k star (bias corrected MLE)	0.173
Theta hat (MLE)	85.19	Theta star (bias corrected MLE)	84.84
nu hat (MLE)	74.6	nu star (bias corrected)	74.9
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (74.90, α)	55.97	Adjusted Chi Square Value (74.90, β)	55.86
95% Gamma Approximate UCL (use when n>=50)	19.6	95% Gamma Adjusted UCL (use when n<50)	19.63

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	14.81	SD (KM)	62.71
Variance (KM)	3932	SE of Mean (KM)	4.278
k hat (KM)	0.0558	k star (KM)	0.0581
nu hat (KM)	24.22	nu star (KM)	25.22
theta hat (KM)	265.4	theta star (KM)	254.9
80% gamma percentile (KM)	3.262	90% gamma percentile (KM)	26.97
95% gamma percentile (KM)	82.42	99% gamma percentile (KM)	303

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.22, α)	14.78	Adjusted Chi Square Value (25.22, β)	14.73
95% Gamma Approximate KM-UCL (use when n>=50)	25.28	95% Gamma Adjusted KM-UCL (use when n<50)	25.37

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.945	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	7.6593E-4	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0958	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.088	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	14.76	Mean in Log Scale	-0.51
SD in Original Scale	62.86	SD in Log Scale	2.603
95% t UCL (assumes normality of ROS data)	21.81	95% Percentile Bootstrap UCL	21.98
95% BCA Bootstrap UCL	24.82	95% Bootstrap t UCL	25.62
95% H-UCL (Log ROS)	35.23		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.0924	KM Geo Mean	1.097
KM SD (logged)	1.891	95% Critical H Value (KM-Log)	3.036
KM Standard Error of Mean (logged)	0.135	95% H-UCL (KM -Log)	9.687
KM SD (logged)	1.891	95% Critical H Value (KM-Log)	3.036
KM Standard Error of Mean (logged)	0.135		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	14.91	Mean in Log Scale	0.229
SD in Original Scale	62.83	SD in Log Scale	1.839
95% t UCL (Assumes normality)	21.96	95% H-Stat UCL	9.912

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	33.46

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total)

General Statistics

Total Number of Observations	217	Number of Distinct Observations	45
		Number of Missing Observations	1
Number of Detects	22	Number of Non-Detects	195
Number of Distinct Detects	22	Number of Distinct Non-Detects	26
Minimum Detect	0.18	Minimum Non-Detect	0.15
Maximum Detect	190	Maximum Non-Detect	33
Variance Detects	1629	Percent Non-Detects	89.86%
Mean Detects	13.04	SD Detects	40.36
Median Detects	1.2	CV Detects	3.096
Skewness Detects	4.403	Kurtosis Detects	19.96
Mean of Logged Detects	0.656	SD of Logged Detects	1.781

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.338	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.42	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.488	KM Standard Error of Mean	0.913
KM SD	13.14	95% KM (BCA) UCL	3.338
95% KM (t) UCL	2.997	95% KM (Percentile Bootstrap) UCL	3.161
95% KM (z) UCL	2.991	95% KM Bootstrap t UCL	11.19
90% KM Chebyshev UCL	4.229	95% KM Chebyshev UCL	5.47
97.5% KM Chebyshev UCL	7.193	99% KM Chebyshev UCL	10.58

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.106	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.836	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.26	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.2	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.351	k star (bias corrected MLE)	0.334
Theta hat (MLE)	37.1	Theta star (bias corrected MLE)	39.06
nu hat (MLE)	15.46	nu star (bias corrected)	14.69
Mean (detects)	13.04		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.352
Maximum	190	Median	0.01
SD	13.19	CV	9.755
k hat (MLE)	0.173	k star (bias corrected MLE)	0.174
Theta hat (MLE)	7.809	Theta star (bias corrected MLE)	7.778
nu hat (MLE)	75.15	nu star (bias corrected)	75.44
Adjusted Level of Significance (β)	0.0489		
Approximate Chi Square Value (75.44, α)	56.44	Adjusted Chi Square Value (75.44, β)	56.33
95% Gamma Approximate UCL (use when n>=50)	1.807	95% Gamma Adjusted UCL (use when n<50)	1.811

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.488	SD (KM)	13.14
Variance (KM)	172.8	SE of Mean (KM)	0.913
k hat (KM)	0.0128	k star (KM)	0.0157
nu hat (KM)	5.564	nu star (KM)	6.821
theta hat (KM)	116.1	theta star (KM)	94.7
80% gamma percentile (KM)	3.6715E-5	90% gamma percentile (KM)	0.0661
95% gamma percentile (KM)	2.105	99% gamma percentile (KM)	42.17

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.82, α)	2.073	Adjusted Chi Square Value (6.82, β)	2.055
95% Gamma Approximate KM-UCL (use when n>=50)	4.898	95% Gamma Adjusted KM-UCL (use when n<50)	4.939

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.93	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.144	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.358	Mean in Log Scale	-5.314
SD in Original Scale	13.19	SD in Log Scale	3.345
95% t UCL (assumes normality of ROS data)	2.837	95% Percentile Bootstrap UCL	3.097
95% BCA Bootstrap UCL	4.247	95% Bootstrap t UCL	11.4
95% H-UCL (Log ROS)	3.937		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.562	KM Geo Mean	0.21
KM SD (logged)	0.985	95% Critical H Value (KM-Log)	2.135
KM Standard Error of Mean (logged)	0.075	95% H-UCL (KM -Log)	0.393
KM SD (logged)	0.985	95% Critical H Value (KM-Log)	2.135
KM Standard Error of Mean (logged)	0.075		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.088	Mean in Log Scale	-0.789
SD in Original Scale	13.21	SD in Log Scale	1.397
95% t UCL (Assumes normality)	3.57	95% H-Stat UCL	1.531

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.393

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Biphenyl (1,1-Biphenyl)

General Statistics

Total Number of Observations	30	Number of Distinct Observations	9
		Number of Missing Observations	172
Number of Detects	1	Number of Non-Detects	29
Number of Distinct Detects	1	Number of Distinct Non-Detects	8

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Biphenyl (1,1-Biphenyl) was not processed!

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

bis(2-Ethylhexyl)phthalate (DEHP)

General Statistics

Total Number of Observations	30	Number of Distinct Observations	9
		Number of Missing Observations	172
Number of Detects	4	Number of Non-Detects	26
Number of Distinct Detects	4	Number of Distinct Non-Detects	5
Minimum Detect	2.7	Minimum Non-Detect	1.6
Maximum Detect	160	Maximum Non-Detect	2.2
Variance Detects	5673	Percent Non-Detects	86.67%
Mean Detects	48.43	SD Detects	75.32
Median Detects	15.5	CV Detects	1.555
Skewness Detects	1.858	Kurtosis Detects	3.461
Mean of Logged Detects	2.625	SD of Logged Detects	1.958

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.741	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.357	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	7.843	KM Standard Error of Mean	6.04
KM SD	28.65	95% KM (BCA) UCL	N/A
95% KM (t) UCL	18.11	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	17.78	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	25.96	95% KM Chebyshev UCL	34.17
97.5% KM Chebyshev UCL	45.56	99% KM Chebyshev UCL	67.94

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.418	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.681	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.306	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.41	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.505	k star (bias corrected MLE)	0.293
Theta hat (MLE)	95.85	Theta star (bias corrected MLE)	165.3
nu hat (MLE)	4.042	nu star (bias corrected)	2.344
Mean (detects)	48.43		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	6.465
Maximum	160	Median	0.01
SD	29.45	CV	4.555
k hat (MLE)	0.141	k star (bias corrected MLE)	0.149
Theta hat (MLE)	45.91	Theta star (bias corrected MLE)	43.4
nu hat (MLE)	8.449	nu star (bias corrected)	8.938
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (8.94, α)	3.289	Adjusted Chi Square Value (8.94, β)	3.094
95% Gamma Approximate UCL (use when n>=50)	17.57	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

bis(2-Ethylhexyl)phthalate (DEHP) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	7.843	SD (KM)	28.65
Variance (KM)	820.7	SE of Mean (KM)	6.04
k hat (KM)	0.075	k star (KM)	0.0897
nu hat (KM)	4.497	nu star (KM)	5.381
theta hat (KM)	104.6	theta star (KM)	87.46
80% gamma percentile (KM)	4.591	90% gamma percentile (KM)	19.85
95% gamma percentile (KM)	45.7	99% gamma percentile (KM)	131.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.38, α)	1.332	Adjusted Chi Square Value (5.38, β)	1.221
95% Gamma Approximate KM-UCL (use when n>=50)	31.68	95% Gamma Adjusted KM-UCL (use when n<50)	34.57

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	6.465	Mean in Log Scale	-7.148
SD in Original Scale	29.45	SD in Log Scale	5.381
95% t UCL (assumes normality of ROS data)	15.6	95% Percentile Bootstrap UCL	17.04
95% BCA Bootstrap UCL	23.38	95% Bootstrap t UCL	262.1
95% H-UCL (Log ROS)	24476440		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.757	KM Geo Mean	2.133
KM SD (logged)	0.959	95% Critical H Value (KM-Log)	2.427
KM Standard Error of Mean (logged)	0.202	95% H-UCL (KM -Log)	5.204
KM SD (logged)	0.959	95% Critical H Value (KM-Log)	2.427
KM Standard Error of Mean (logged)	0.202		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	7.243	Mean in Log Scale	0.26
SD in Original Scale	29.27	SD in Log Scale	1.139
95% t UCL (Assumes normality)	16.32	95% H-Stat UCL	4.355

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	18.11

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	119	Number of Distinct Observations	24
		Number of Missing Observations	83
Number of Detects	10	Number of Non-Detects	109
Number of Distinct Detects	10	Number of Distinct Non-Detects	15
Minimum Detect	0.32	Minimum Non-Detect	0.06
Maximum Detect	9.8	Maximum Non-Detect	11
Variance Detects	9.33	Percent Non-Detects	91.6%
Mean Detects	2.668	SD Detects	3.055
Median Detects	1.35	CV Detects	1.145
Skewness Detects	1.672	Kurtosis Detects	2.539
Mean of Logged Detects	0.383	SD of Logged Detects	1.192

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.773	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.303	KM Standard Error of Mean	0.109
KM SD	1.113	95% KM (BCA) UCL	0.48
95% KM (t) UCL	0.484	95% KM (Percentile Bootstrap) UCL	0.489
95% KM (z) UCL	0.483	95% KM Bootstrap t UCL	0.63
90% KM Chebyshev UCL	0.63	95% KM Chebyshev UCL	0.778
97.5% KM Chebyshev UCL	0.984	99% KM Chebyshev UCL	1.388

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.434	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.274	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.969	k star (bias corrected MLE)	0.745
Theta hat (MLE)	2.754	Theta star (bias corrected MLE)	3.583
nu hat (MLE)	19.37	nu star (bias corrected)	14.89
Mean (detects)	2.668		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.24
Maximum	9.8	Median	0.01
SD	1.123	CV	4.673
k hat (MLE)	0.261	k star (bias corrected MLE)	0.26
Theta hat (MLE)	0.92	Theta star (bias corrected MLE)	0.923
nu hat (MLE)	62.16	nu star (bias corrected)	61.93
Adjusted Level of Significance (β)	0.048		
Approximate Chi Square Value (61.93, α)	44.83	Adjusted Chi Square Value (61.93, β)	44.65
95% Gamma Approximate UCL (use when n>=50)	0.332	95% Gamma Adjusted UCL (use when n<50)	0.333

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.303	SD (KM)	1.113
Variance (KM)	1.239	SE of Mean (KM)	0.109
k hat (KM)	0.0743	k star (KM)	0.078
nu hat (KM)	17.67	nu star (KM)	18.56
theta hat (KM)	4.084	theta star (KM)	3.889
80% gamma percentile (KM)	0.137	90% gamma percentile (KM)	0.707
95% gamma percentile (KM)	1.761	99% gamma percentile (KM)	5.436

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (18.56, α)	9.799	Adjusted Chi Square Value (18.56, β)	9.721
95% Gamma Approximate KM-UCL (use when n>=50)	0.575	95% Gamma Adjusted KM-UCL (use when n<50)	0.579

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.148	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.268	Mean in Log Scale	-4.272
SD in Original Scale	1.12	SD in Log Scale	2.433
95% t UCL (assumes normality of ROS data)	0.438	95% Percentile Bootstrap UCL	0.457
95% BCA Bootstrap UCL	0.529	95% Bootstrap t UCL	0.638
95% H-UCL (Log ROS)	0.643		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.42	KM Geo Mean	0.0889
KM SD (logged)	1.024	95% Critical H Value (KM-Log)	2.244
KM Standard Error of Mean (logged)	0.128	95% H-UCL (KM -Log)	0.186
KM SD (logged)	1.024	95% Critical H Value (KM-Log)	2.244
KM Standard Error of Mean (logged)	0.128		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.646	Mean in Log Scale	-1.158
SD in Original Scale	1.17	SD in Log Scale	1.306
95% t UCL (Assumes normality)	0.824	95% H-Stat UCL	1

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.575

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	132	Number of Distinct Observations	85
		Number of Missing Observations	86
Number of Detects	98	Number of Non-Detects	34
Number of Distinct Detects	83	Number of Distinct Non-Detects	4
Minimum Detect	34	Minimum Non-Detect	34
Maximum Detect	120000	Maximum Non-Detect	2200
Variance Detects	2.391E+8	Percent Non-Detects	25.76%
Mean Detects	5308	SD Detects	15463
Median Detects	410	CV Detects	2.913
Skewness Detects	5.262	Kurtosis Detects	33.24
Mean of Logged Detects	6.345	SD of Logged Detects	2.102

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.397	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.367	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0897	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3956	KM Standard Error of Mean	1177
KM SD	13453	95% KM (BCA) UCL	6141
95% KM (t) UCL	5906	95% KM (Percentile Bootstrap) UCL	6228
95% KM (z) UCL	5892	95% KM Bootstrap t UCL	7296
90% KM Chebyshev UCL	7487	95% KM Chebyshev UCL	9087
97.5% KM Chebyshev UCL	11306	99% KM Chebyshev UCL	15667

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.879	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.866	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.098	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.308	k star (bias corrected MLE)	0.305
Theta hat (MLE)	17251	Theta star (bias corrected MLE)	17399
nu hat (MLE)	60.31	nu star (bias corrected)	59.79
Mean (detects)	5308		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3941
Maximum	120000	Median	150
SD	13509	CV	3.428
k hat (MLE)	0.16	k star (bias corrected MLE)	0.162
Theta hat (MLE)	24612	Theta star (bias corrected MLE)	24397
nu hat (MLE)	42.27	nu star (bias corrected)	42.64
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (42.64, α)	28.67	Adjusted Chi Square Value (42.64, β)	28.54
95% Gamma Approximate UCL (use when n>=50)	5861	95% Gamma Adjusted UCL (use when n<50)	5887

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3956	SD (KM)	13453
Variance (KM)	1.810E+8	SE of Mean (KM)	1177
k hat (KM)	0.0865	k star (KM)	0.0896
nu hat (KM)	22.83	nu star (KM)	23.65
theta hat (KM)	45744	theta star (KM)	44168
80% gamma percentile (KM)	2311	90% gamma percentile (KM)	10006
95% gamma percentile (KM)	23052	99% gamma percentile (KM)	66362

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (23.65, α)	13.58	Adjusted Chi Square Value (23.65, β)	13.5
95% Gamma Approximate KM-UCL (use when n>=50)	6889	95% Gamma Adjusted KM-UCL (use when n<50)	6932

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.918	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.2444E-6	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.106	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0897	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3952	Mean in Log Scale	5.399
SD in Original Scale	13505	SD in Log Scale	2.561
95% t UCL (assumes normality of ROS data)	5899	95% Percentile Bootstrap UCL	5986
95% BCA Bootstrap UCL	6884	95% Bootstrap t UCL	7254
95% H-UCL (Log ROS)	14228		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.708	KM Geo Mean	301.4
KM SD (logged)	2.119	95% Critical H Value (KM-Log)	3.411
KM Standard Error of Mean (logged)	0.187	95% H-UCL (KM -Log)	5352
KM SD (logged)	2.119	95% Critical H Value (KM-Log)	3.411
KM Standard Error of Mean (logged)	0.187		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3965	Mean in Log Scale	5.733
SD in Original Scale	13502	SD in Log Scale	2.149
95% t UCL (Assumes normality)	5912	95% H-Stat UCL	5940

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	9087

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	132	Number of Distinct Observations	36
		Number of Missing Observations	86
Number of Detects	42	Number of Non-Detects	90
Number of Distinct Detects	32	Number of Distinct Non-Detects	9
Minimum Detect	0.57	Minimum Non-Detect	0.57
Maximum Detect	23	Maximum Non-Detect	10
Variance Detects	17.19	Percent Non-Detects	68.18%
Mean Detects	2.903	SD Detects	4.146
Median Detects	1.45	CV Detects	1.428
Skewness Detects	3.439	Kurtosis Detects	13.76
Mean of Logged Detects	0.562	SD of Logged Detects	0.898

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.559	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.291	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.387	KM Standard Error of Mean	0.231
KM SD	2.579	95% KM (BCA) UCL	1.817
95% KM (t) UCL	1.77	95% KM (Percentile Bootstrap) UCL	1.778
95% KM (z) UCL	1.767	95% KM Bootstrap t UCL	1.995
90% KM Chebyshev UCL	2.081	95% KM Chebyshev UCL	2.395
97.5% KM Chebyshev UCL	2.831	99% KM Chebyshev UCL	3.688

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.623	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.775	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.2	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.14	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.13	k star (bias corrected MLE)	1.065
Theta hat (MLE)	2.569	Theta star (bias corrected MLE)	2.725
nu hat (MLE)	94.93	nu star (bias corrected)	89.48
Mean (detects)	2.903		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.023
Maximum	23	Median	0.01
SD	2.716	CV	2.655
k hat (MLE)	0.254	k star (bias corrected MLE)	0.253
Theta hat (MLE)	4.029	Theta star (bias corrected MLE)	4.04
nu hat (MLE)	67.04	nu star (bias corrected)	66.85
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (66.85, α)	49.03	Adjusted Chi Square Value (66.85, β)	48.86
95% Gamma Approximate UCL (use when n>=50)	1.395	95% Gamma Adjusted UCL (use when n<50)	1.4

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.387	SD (KM)	2.579
Variance (KM)	6.649	SE of Mean (KM)	0.231
k hat (KM)	0.289	k star (KM)	0.288
nu hat (KM)	76.33	nu star (KM)	75.93
theta hat (KM)	4.795	theta star (KM)	4.821
80% gamma percentile (KM)	2.103	90% gamma percentile (KM)	4.109
95% gamma percentile (KM)	6.428	99% gamma percentile (KM)	12.49

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (75.93, α)	56.86	Adjusted Chi Square Value (75.93, β)	56.68
95% Gamma Approximate KM-UCL (use when n>=50)	1.852	95% Gamma Adjusted KM-UCL (use when n<50)	1.858

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.87	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.942	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.131	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.135	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.126	Mean in Log Scale	-1.067
SD in Original Scale	2.649	SD in Log Scale	1.532
95% t UCL (assumes normality of ROS data)	1.508	95% Percentile Bootstrap UCL	1.529
95% BCA Bootstrap UCL	1.687	95% Bootstrap t UCL	1.797
95% H-UCL (Log ROS)	1.602		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.15	KM Geo Mean	0.861
KM SD (logged)	0.746	95% Critical H Value (KM-Log)	1.985
KM Standard Error of Mean (logged)	0.0696	95% H-UCL (KM -Log)	1.294
KM SD (logged)	0.746	95% Critical H Value (KM-Log)	1.985
KM Standard Error of Mean (logged)	0.0696		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.818	Mean in Log Scale	-0.217
SD in Original Scale	2.905	SD in Log Scale	1.205
95% t UCL (Assumes normality)	2.236	95% H-Stat UCL	2.14

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1.294

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	132	Number of Distinct Observations	67
		Number of Missing Observations	86
Number of Detects	105	Number of Non-Detects	27
Number of Distinct Detects	64	Number of Distinct Non-Detects	5
Minimum Detect	0.87	Minimum Non-Detect	0.75
Maximum Detect	820	Maximum Non-Detect	10
Variance Detects	8405	Percent Non-Detects	20.45%
Mean Detects	25.75	SD Detects	91.68
Median Detects	4.1	CV Detects	3.56
Skewness Detects	6.952	Kurtosis Detects	56.01
Mean of Logged Detects	1.701	SD of Logged Detects	1.378

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.299	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.393	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0867	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	20.92	KM Standard Error of Mean	7.166
KM SD	81.94	95% KM (BCA) UCL	35.27
95% KM (t) UCL	32.79	95% KM (Percentile Bootstrap) UCL	34.15
95% KM (z) UCL	32.71	95% KM Bootstrap t UCL	46.33
90% KM Chebyshev UCL	42.42	95% KM Chebyshev UCL	52.16
97.5% KM Chebyshev UCL	65.67	99% KM Chebyshev UCL	92.22

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	13.95	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.838	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.308	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0942	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.422	k star (bias corrected MLE)	0.416
Theta hat (MLE)	61.1	Theta star (bias corrected MLE)	61.94
nu hat (MLE)	88.52	nu star (bias corrected)	87.32
Mean (detects)	25.75		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	21.04
Maximum	820	Median	3.2
SD	82.3	CV	3.912
k hat (MLE)	0.287	k star (bias corrected MLE)	0.285
Theta hat (MLE)	73.34	Theta star (bias corrected MLE)	73.72
nu hat (MLE)	75.73	nu star (bias corrected)	75.34
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (75.34, α)	56.35	Adjusted Chi Square Value (75.34, β)	56.17
95% Gamma Approximate UCL (use when n>=50)	28.13	95% Gamma Adjusted UCL (use when n<50)	28.22

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	20.92	SD (KM)	81.94
Variance (KM)	6714	SE of Mean (KM)	7.166
k hat (KM)	0.0652	k star (KM)	0.0687
nu hat (KM)	17.21	nu star (KM)	18.15
theta hat (KM)	320.9	theta star (KM)	304.3
80% gamma percentile (KM)	7.183	90% gamma percentile (KM)	44.49
95% gamma percentile (KM)	120.1	99% gamma percentile (KM)	397.4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (18.15, α)	9.499	Adjusted Chi Square Value (18.15, β)	9.43
95% Gamma Approximate KM-UCL (use when n>=50)	39.97	95% Gamma Adjusted KM-UCL (use when n<50)	40.26

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.864	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	3.741E-14	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0867	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	20.95	Mean in Log Scale	1.351
SD in Original Scale	82.25	SD in Log Scale	1.532
95% t UCL (assumes normality of ROS data)	32.81	95% Percentile Bootstrap UCL	33.78
95% BCA Bootstrap UCL	39.06	95% Bootstrap t UCL	47.33
95% H-UCL (Log ROS)	17.99		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.438	KM Geo Mean	4.212
KM SD (logged)	1.375	95% Critical H Value (KM-Log)	2.558
KM Standard Error of Mean (logged)	0.122	95% H-UCL (KM -Log)	14.74
KM SD (logged)	1.375	95% Critical H Value (KM-Log)	2.558
KM Standard Error of Mean (logged)	0.122		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	21.08	Mean in Log Scale	1.459
SD in Original Scale	82.22	SD in Log Scale	1.427
95% t UCL (Assumes normality)	32.94	95% H-Stat UCL	16.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	52.16

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	132	Number of Distinct Observations	64
		Number of Missing Observations	86
Number of Detects	130	Number of Non-Detects	2
Number of Distinct Detects	64	Number of Distinct Non-Detects	2
Minimum Detect	84	Minimum Non-Detect	100
Maximum Detect	5000	Maximum Non-Detect	120
Variance Detects	485817	Percent Non-Detects	1.515%
Mean Detects	485.5	SD Detects	697
Median Detects	240	CV Detects	1.436
Skewness Detects	3.645	Kurtosis Detects	16.9
Mean of Logged Detects	5.634	SD of Logged Detects	0.96

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.591	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0781	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	479.6	KM Standard Error of Mean	60.35
KM SD	690.7	95% KM (BCA) UCL	583.6
95% KM (t) UCL	579.6	95% KM (Percentile Bootstrap) UCL	586.4
95% KM (z) UCL	578.9	95% KM Bootstrap t UCL	608.9
90% KM Chebyshev UCL	660.6	95% KM Chebyshev UCL	742.7
97.5% KM Chebyshev UCL	856.5	99% KM Chebyshev UCL	1080

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.655	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.782	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.154	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0841	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.042	k star (bias corrected MLE)	1.023
Theta hat (MLE)	466	Theta star (bias corrected MLE)	474.6
nu hat (MLE)	270.9	nu star (bias corrected)	266
Mean (detects)	485.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	478.1
Maximum	5000	Median	235
SD	694.2	CV	1.452
k hat (MLE)	0.852	k star (bias corrected MLE)	0.837
Theta hat (MLE)	561.4	Theta star (bias corrected MLE)	571
nu hat (MLE)	224.8	nu star (bias corrected)	221.1
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (221.06, α)	187.6	Adjusted Chi Square Value (221.06, β)	187.3
95% Gamma Approximate UCL (use when n>=50)	563.3	95% Gamma Adjusted UCL (use when n<50)	564.3

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	479.6	SD (KM)	690.7
Variance (KM)	477032	SE of Mean (KM)	60.35
k hat (KM)	0.482	k star (KM)	0.476
nu hat (KM)	127.3	nu star (KM)	125.7
theta hat (KM)	994.6	theta star (KM)	1007
80% gamma percentile (KM)	785.8	90% gamma percentile (KM)	1311
95% gamma percentile (KM)	1874	99% gamma percentile (KM)	3268

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (125.74, α)	100.8	Adjusted Chi Square Value (125.74, β)	100.6
95% Gamma Approximate KM-UCL (use when n>=50)	598	95% Gamma Adjusted KM-UCL (use when n<50)	599.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.897	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	7.336E-13	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.134	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0781	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	479.2	Mean in Log Scale	5.612
SD in Original Scale	693.5	SD in Log Scale	0.969
95% t UCL (assumes normality of ROS data)	579.2	95% Percentile Bootstrap UCL	586.7
95% BCA Bootstrap UCL	603.6	95% Bootstrap t UCL	605.3
95% H-UCL (Log ROS)	526		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.618	KM Geo Mean	275.2
KM SD (logged)	0.958	95% Critical H Value (KM-Log)	2.156
KM Standard Error of Mean (logged)	0.0838	95% H-UCL (KM -Log)	521.9
KM SD (logged)	0.958	95% Critical H Value (KM-Log)	2.156
KM Standard Error of Mean (logged)	0.0838		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	479	Mean in Log Scale	5.609
SD in Original Scale	693.7	SD in Log Scale	0.974
95% t UCL (Assumes normality)	579	95% H-Stat UCL	527.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	742.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Beryllium

General Statistics

Total Number of Observations	132	Number of Distinct Observations	31
		Number of Missing Observations	86
Number of Detects	34	Number of Non-Detects	98
Number of Distinct Detects	27	Number of Distinct Non-Detects	5
Minimum Detect	0.31	Minimum Non-Detect	0.31
Maximum Detect	5.4	Maximum Non-Detect	5
Variance Detects	1.583	Percent Non-Detects	74.24%
Mean Detects	1.153	SD Detects	1.258
Median Detects	0.605	CV Detects	1.091
Skewness Detects	2.175	Kurtosis Detects	4.223
Mean of Logged Detects	-0.244	SD of Logged Detects	0.82

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.675	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.279	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.558	KM Standard Error of Mean	0.0713
KM SD	0.763	95% KM (BCA) UCL	0.685
95% KM (t) UCL	0.676	95% KM (Percentile Bootstrap) UCL	0.684
95% KM (z) UCL	0.675	95% KM Bootstrap t UCL	0.731
90% KM Chebyshev UCL	0.772	95% KM Chebyshev UCL	0.869
97.5% KM Chebyshev UCL	1.003	99% KM Chebyshev UCL	1.267

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.998	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.767	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.172	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.154	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.437	k star (bias corrected MLE)	1.33
Theta hat (MLE)	0.802	Theta star (bias corrected MLE)	0.867
nu hat (MLE)	97.73	nu star (bias corrected)	90.44
Mean (detects)	1.153		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.338
Maximum	5.4	Median	0.01
SD	0.823	CV	2.434
k hat (MLE)	0.306	k star (bias corrected MLE)	0.305
Theta hat (MLE)	1.103	Theta star (bias corrected MLE)	1.11
nu hat (MLE)	80.9	nu star (bias corrected)	80.39
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (80.39, α)	60.73	Adjusted Chi Square Value (80.39, β)	60.54
95% Gamma Approximate UCL (use when n>=50)	0.447	95% Gamma Adjusted UCL (use when n<50)	0.449

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Beryllium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.558	SD (KM)	0.763
Variance (KM)	0.582	SE of Mean (KM)	0.0713
k hat (KM)	0.535	k star (KM)	0.527
nu hat (KM)	141.1	nu star (KM)	139.3
theta hat (KM)	1.044	theta star (KM)	1.058
80% gamma percentile (KM)	0.918	90% gamma percentile (KM)	1.493
95% gamma percentile (KM)	2.103	99% gamma percentile (KM)	3.596

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (139.26, α)	113	Adjusted Chi Square Value (139.26, β)	112.7
95% Gamma Approximate KM-UCL (use when n>=50)	0.688	95% Gamma Adjusted KM-UCL (use when n<50)	0.689

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.89	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.149	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.15	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.39	Mean in Log Scale	-2.066
SD in Original Scale	0.794	SD in Log Scale	1.523
95% t UCL (assumes normality of ROS data)	0.505	95% Percentile Bootstrap UCL	0.51
95% BCA Bootstrap UCL	0.558	95% Bootstrap t UCL	0.545
95% H-UCL (Log ROS)	0.581		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.894	KM Geo Mean	0.409
KM SD (logged)	0.608	95% Critical H Value (KM-Log)	1.89
KM Standard Error of Mean (logged)	0.0575	95% H-UCL (KM -Log)	0.544
KM SD (logged)	0.608	95% Critical H Value (KM-Log)	1.89
KM Standard Error of Mean (logged)	0.0575		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.753	Mean in Log Scale	-1.033
SD in Original Scale	1.047	SD in Log Scale	1.133
95% t UCL (Assumes normality)	0.904	95% H-Stat UCL	0.851

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.544

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	132	Number of Distinct Observations	27
		Number of Missing Observations	86
Number of Detects	32	Number of Non-Detects	100
Number of Distinct Detects	25	Number of Distinct Non-Detects	2
Minimum Detect	0.22	Minimum Non-Detect	0.21
Maximum Detect	14	Maximum Non-Detect	2
Variance Detects	6.758	Percent Non-Detects	75.76%
Mean Detects	1.484	SD Detects	2.6
Median Detects	0.43	CV Detects	1.752
Skewness Detects	3.89	Kurtosis Detects	17.88
Mean of Logged Detects	-0.381	SD of Logged Detects	1.137

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.519	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.313	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.527	KM Standard Error of Mean	0.122
KM SD	1.374	95% KM (BCA) UCL	0.754
95% KM (t) UCL	0.729	95% KM (Percentile Bootstrap) UCL	0.745
95% KM (z) UCL	0.728	95% KM Bootstrap t UCL	0.937
90% KM Chebyshev UCL	0.892	95% KM Chebyshev UCL	1.058
97.5% KM Chebyshev UCL	1.287	99% KM Chebyshev UCL	1.738

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.779	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.787	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.277	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.161	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.769	k star (bias corrected MLE)	0.718
Theta hat (MLE)	1.928	Theta star (bias corrected MLE)	2.066
nu hat (MLE)	49.24	nu star (bias corrected)	45.96
Mean (detects)	1.484		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.38
Maximum	14	Median	0.01
SD	1.416	CV	3.728
k hat (MLE)	0.275	k star (bias corrected MLE)	0.273
Theta hat (MLE)	1.384	Theta star (bias corrected MLE)	1.39
nu hat (MLE)	72.48	nu star (bias corrected)	72.17
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (72.17, α)	53.6	Adjusted Chi Square Value (72.17, β)	53.43
95% Gamma Approximate UCL (use when n>=50)	0.511	95% Gamma Adjusted UCL (use when n<50)	0.513

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.527	SD (KM)	1.374
Variance (KM)	1.887	SE of Mean (KM)	0.122
k hat (KM)	0.147	k star (KM)	0.149
nu hat (KM)	38.91	nu star (KM)	39.36
theta hat (KM)	3.578	theta star (KM)	3.537
80% gamma percentile (KM)	0.571	90% gamma percentile (KM)	1.562
95% gamma percentile (KM)	2.906	99% gamma percentile (KM)	6.809

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (39.36, α)	25.99	Adjusted Chi Square Value (39.36, β)	25.87
95% Gamma Approximate KM-UCL (use when n>=50)	0.799	95% Gamma Adjusted KM-UCL (use when n<50)	0.802

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.841	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.93	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.227	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.154	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.398	Mean in Log Scale	-3.159
SD in Original Scale	1.409	SD in Log Scale	2.198
95% t UCL (assumes normality of ROS data)	0.601	95% Percentile Bootstrap UCL	0.627
95% BCA Bootstrap UCL	0.739	95% Bootstrap t UCL	0.791
95% H-UCL (Log ROS)	0.932		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.254	KM Geo Mean	0.285
KM SD (logged)	0.755	95% Critical H Value (KM-Log)	1.991
KM Standard Error of Mean (logged)	0.0681	95% H-UCL (KM -Log)	0.432
KM SD (logged)	0.755	95% Critical H Value (KM-Log)	1.991
KM Standard Error of Mean (logged)	0.0681		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.568	Mean in Log Scale	-1.475
SD in Original Scale	1.401	SD in Log Scale	1.135
95% t UCL (Assumes normality)	0.77	95% H-Stat UCL	0.548

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1.058

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium

General Statistics

Total Number of Observations	132	Number of Distinct Observations	54
		Number of Missing Observations	86
Number of Detects	73	Number of Non-Detects	59
Number of Distinct Detects	53	Number of Distinct Non-Detects	3
Minimum Detect	0.99	Minimum Non-Detect	0.98
Maximum Detect	610	Maximum Non-Detect	30
Variance Detects	7556	Percent Non-Detects	44.7%
Mean Detects	33.21	SD Detects	86.93
Median Detects	3.8	CV Detects	2.617
Skewness Detects	4.879	Kurtosis Detects	28.18
Mean of Logged Detects	1.926	SD of Logged Detects	1.627

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.423	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.355	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	18.96	KM Standard Error of Mean	5.797
KM SD	66.14	95% KM (BCA) UCL	29.25
95% KM (t) UCL	28.56	95% KM (Percentile Bootstrap) UCL	29.08
95% KM (z) UCL	28.49	95% KM Bootstrap t UCL	36.69
90% KM Chebyshev UCL	36.35	95% KM Chebyshev UCL	44.22
97.5% KM Chebyshev UCL	55.16	99% KM Chebyshev UCL	76.63

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.261	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.838	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.249	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.112	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.415	k star (bias corrected MLE)	0.407
Theta hat (MLE)	80.04	Theta star (bias corrected MLE)	81.6
nu hat (MLE)	60.58	nu star (bias corrected)	59.43
Mean (detects)	33.21		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	18.45
Maximum	610	Median	1.3
SD	66.52	CV	3.605
k hat (MLE)	0.194	k star (bias corrected MLE)	0.194
Theta hat (MLE)	95.32	Theta star (bias corrected MLE)	95
nu hat (MLE)	51.11	nu star (bias corrected)	51.28
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (51.28, α)	35.84	Adjusted Chi Square Value (51.28, β)	35.69
95% Gamma Approximate UCL (use when n>=50)	26.41	95% Gamma Adjusted UCL (use when n<50)	26.51

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	18.96	SD (KM)	66.14
Variance (KM)	4374	SE of Mean (KM)	5.797
k hat (KM)	0.0822	k star (KM)	0.0853
nu hat (KM)	21.69	nu star (KM)	22.53
theta hat (KM)	230.7	theta star (KM)	222.1
80% gamma percentile (KM)	10.18	90% gamma percentile (KM)	46.71
95% gamma percentile (KM)	110.4	99% gamma percentile (KM)	325.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.53, α)	12.74	Adjusted Chi Square Value (22.53, β)	12.66
95% Gamma Approximate KM-UCL (use when n>=50)	33.53	95% Gamma Adjusted KM-UCL (use when n<50)	33.75

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.883	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.7003E-7	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.178	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.104	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	18.66	Mean in Log Scale	0.402
SD in Original Scale	66.47	SD in Log Scale	2.322
95% t UCL (assumes normality of ROS data)	28.25	95% Percentile Bootstrap UCL	28.67
95% BCA Bootstrap UCL	33.89	95% Bootstrap t UCL	37.43
95% H-UCL (Log ROS)	46.59		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.127	KM Geo Mean	3.087
KM SD (logged)	1.52	95% Critical H Value (KM-Log)	2.715
KM Standard Error of Mean (logged)	0.135	95% H-UCL (KM -Log)	14.05
KM SD (logged)	1.52	95% Critical H Value (KM-Log)	2.715
KM Standard Error of Mean (logged)	0.135		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	19.19	Mean in Log Scale	1.047
SD in Original Scale	66.35	SD in Log Scale	1.689
95% t UCL (Assumes normality)	28.76	95% H-Stat UCL	18.18

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	44.22

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	132	Number of Distinct Observations	74
		Number of Missing Observations	86
Number of Detects	112	Number of Non-Detects	20
Number of Distinct Detects	71	Number of Distinct Non-Detects	4
Minimum Detect	0.2	Minimum Non-Detect	0.19
Maximum Detect	100	Maximum Non-Detect	7
Variance Detects	218.7	Percent Non-Detects	15.15%
Mean Detects	5.831	SD Detects	14.79
Median Detects	1.05	CV Detects	2.536
Skewness Detects	4.389	Kurtosis Detects	21.11
Mean of Logged Detects	0.399	SD of Logged Detects	1.456

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.42	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.352	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.084	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.097	KM Standard Error of Mean	1.197
KM SD	13.68	95% KM (BCA) UCL	7.135
95% KM (t) UCL	7.079	95% KM (Percentile Bootstrap) UCL	7.065
95% KM (z) UCL	7.065	95% KM Bootstrap t UCL	8.124
90% KM Chebyshev UCL	8.687	95% KM Chebyshev UCL	10.31
97.5% KM Chebyshev UCL	12.57	99% KM Chebyshev UCL	17

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	9.559	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.826	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.213	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0917	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.47	k star (bias corrected MLE)	0.464
Theta hat (MLE)	12.4	Theta star (bias corrected MLE)	12.58
nu hat (MLE)	105.3	nu star (bias corrected)	103.8
Mean (detects)	5.831		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.151
Maximum	100	Median	0.978
SD	13.75	CV	2.67
k hat (MLE)	0.375	k star (bias corrected MLE)	0.372
Theta hat (MLE)	13.73	Theta star (bias corrected MLE)	13.85
nu hat (MLE)	99.08	nu star (bias corrected)	98.16
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (98.16, α)	76.31	Adjusted Chi Square Value (98.16, β)	76.1
95% Gamma Approximate UCL (use when n>=50)	6.627	95% Gamma Adjusted UCL (use when n<50)	6.645

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.097	SD (KM)	13.68
Variance (KM)	187.1	SE of Mean (KM)	1.197
k hat (KM)	0.139	k star (KM)	0.141
nu hat (KM)	36.65	nu star (KM)	37.15
theta hat (KM)	36.71	theta star (KM)	36.22
80% gamma percentile (KM)	5.252	90% gamma percentile (KM)	14.96
95% gamma percentile (KM)	28.39	99% gamma percentile (KM)	67.87

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (37.15, α)	24.2	Adjusted Chi Square Value (37.15, β)	24.08
95% Gamma Approximate KM-UCL (use when n>=50)	7.826	95% Gamma Adjusted KM-UCL (use when n<50)	7.863

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.898	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.686E-10	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.136	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.084	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.099	Mean in Log Scale	0.205
SD in Original Scale	13.73	SD in Log Scale	1.536
95% t UCL (assumes normality of ROS data)	7.079	95% Percentile Bootstrap UCL	7.127
95% BCA Bootstrap UCL	7.776	95% Bootstrap t UCL	8.226
95% H-UCL (Log ROS)	5.761		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.251	KM Geo Mean	1.285
KM SD (logged)	1.435	95% Critical H Value (KM-Log)	2.623
KM Standard Error of Mean (logged)	0.129	95% H-UCL (KM -Log)	5.002
KM SD (logged)	1.435	95% Critical H Value (KM-Log)	2.623
KM Standard Error of Mean (logged)	0.129		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.318	Mean in Log Scale	0.379
SD in Original Scale	13.68	SD in Log Scale	1.469
95% t UCL (Assumes normality)	7.29	95% H-Stat UCL	6.042

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	10.31

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	132	Number of Distinct Observations	55
		Number of Missing Observations	86
Number of Detects	68	Number of Non-Detects	64
Number of Distinct Detects	50	Number of Distinct Non-Detects	9
Minimum Detect	1.7	Minimum Non-Detect	1.7
Maximum Detect	1900	Maximum Non-Detect	54
Variance Detects	57291	Percent Non-Detects	48.48%
Mean Detects	67.8	SD Detects	239.4
Median Detects	7.9	CV Detects	3.53
Skewness Detects	6.967	Kurtosis Detects	53.01
Mean of Logged Detects	2.469	SD of Logged Detects	1.646

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.296	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.391	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.107	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	36.3	KM Standard Error of Mean	15.22
KM SD	173.6	95% KM (BCA) UCL	67.12
95% KM (t) UCL	61.52	95% KM (Percentile Bootstrap) UCL	65.68
95% KM (z) UCL	61.34	95% KM Bootstrap t UCL	109.5
90% KM Chebyshev UCL	81.97	95% KM Chebyshev UCL	102.7
97.5% KM Chebyshev UCL	131.4	99% KM Chebyshev UCL	187.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	6.111	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.846	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.228	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.116	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.38	k star (bias corrected MLE)	0.373
Theta hat (MLE)	178.6	Theta star (bias corrected MLE)	181.9
nu hat (MLE)	51.64	nu star (bias corrected)	50.69
Mean (detects)	67.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	35.8
Maximum	1900	Median	1.8
SD	174.5	CV	4.874
k hat (MLE)	0.173	k star (bias corrected MLE)	0.174
Theta hat (MLE)	207.2	Theta star (bias corrected MLE)	205.9
nu hat (MLE)	45.6	nu star (bias corrected)	45.9
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (45.90, α)	31.35	Adjusted Chi Square Value (45.90, β)	31.22
95% Gamma Approximate UCL (use when n>=50)	52.4	95% Gamma Adjusted UCL (use when n<50)	52.62

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	36.3	SD (KM)	173.6
Variance (KM)	30140	SE of Mean (KM)	15.22
k hat (KM)	0.0437	k star (KM)	0.0478
nu hat (KM)	11.54	nu star (KM)	12.61
theta hat (KM)	830.3	theta star (KM)	759.8
80% gamma percentile (KM)	4.172	90% gamma percentile (KM)	52.1
95% gamma percentile (KM)	189.8	99% gamma percentile (KM)	803.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.61, α)	5.633	Adjusted Chi Square Value (12.61, β)	5.581
95% Gamma Approximate KM-UCL (use when n>=50)	81.27	95% Gamma Adjusted KM-UCL (use when n<50)	82.02

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.903	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.4431E-5	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.123	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.107	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	35.7	Mean in Log Scale	0.88
SD in Original Scale	174.4	SD in Log Scale	2.311
95% t UCL (assumes normality of ROS data)	60.84	95% Percentile Bootstrap UCL	64.19
95% BCA Bootstrap UCL	80.31	95% Bootstrap t UCL	107
95% H-UCL (Log ROS)	72.67		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.641	KM Geo Mean	5.161
KM SD (logged)	1.504	95% Critical H Value (KM-Log)	2.698
KM Standard Error of Mean (logged)	0.136	95% H-UCL (KM -Log)	22.8
KM SD (logged)	1.504	95% Critical H Value (KM-Log)	2.698
KM Standard Error of Mean (logged)	0.136		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	37.84	Mean in Log Scale	1.716
SD in Original Scale	174	SD in Log Scale	1.695
95% t UCL (Assumes normality)	62.94	95% H-Stat UCL	35.97

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	102.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	30	Number of Distinct Observations	11
		Number of Missing Observations	172
Number of Detects	7	Number of Non-Detects	23
Number of Distinct Detects	7	Number of Distinct Non-Detects	4
Minimum Detect	7.4	Minimum Non-Detect	5
Maximum Detect	580	Maximum Non-Detect	12
Variance Detects	49394	Percent Non-Detects	76.67%
Mean Detects	178.5	SD Detects	222.2
Median Detects	86	CV Detects	1.245
Skewness Detects	1.276	Kurtosis Detects	0.394
Mean of Logged Detects	4.169	SD of Logged Detects	1.766

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.81	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.265	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	45.49	KM Standard Error of Mean	24.36
KM SD	123.5	95% KM (BCA) UCL	84.72
95% KM (t) UCL	86.88	95% KM (Percentile Bootstrap) UCL	86.3
95% KM (z) UCL	85.56	95% KM Bootstrap t UCL	175.4
90% KM Chebyshev UCL	118.6	95% KM Chebyshev UCL	151.7
97.5% KM Chebyshev UCL	197.6	99% KM Chebyshev UCL	287.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.292	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.17	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.325	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.607	k star (bias corrected MLE)	0.442
Theta hat (MLE)	293.8	Theta star (bias corrected MLE)	403.5
nu hat (MLE)	8.503	nu star (bias corrected)	6.192
Mean (detects)	178.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	41.65
Maximum	580	Median	0.01
SD	126.9	CV	3.048
k hat (MLE)	0.125	k star (bias corrected MLE)	0.135
Theta hat (MLE)	332.2	Theta star (bias corrected MLE)	308.3
nu hat (MLE)	7.523	nu star (bias corrected)	8.104
Adjusted Level of Significance (β)	0.041		
Approximate Chi Square Value (8.10, α)	2.795	Adjusted Chi Square Value (8.10, β)	2.618
95% Gamma Approximate UCL (use when n>=50)	120.7	95% Gamma Adjusted UCL (use when n<50)	128.9

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	45.49	SD (KM)	123.5
Variance (KM)	15260	SE of Mean (KM)	24.36
k hat (KM)	0.136	k star (KM)	0.144
nu hat (KM)	8.136	nu star (KM)	8.656
theta hat (KM)	335.5	theta star (KM)	315.3
80% gamma percentile (KM)	47.91	90% gamma percentile (KM)	134.1
95% gamma percentile (KM)	252.2	99% gamma percentile (KM)	597.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.66, α)	3.12	Adjusted Chi Square Value (8.66, β)	2.931
95% Gamma Approximate KM-UCL (use when n>=50)	126.2	95% Gamma Adjusted KM-UCL (use when n<50)	134.3

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	41.97	Mean in Log Scale	-1.178
SD in Original Scale	126.8	SD in Log Scale	3.834
95% t UCL (assumes normality of ROS data)	81.31	95% Percentile Bootstrap UCL	82.35
95% BCA Bootstrap UCL	107	95% Bootstrap t UCL	193.5
95% H-UCL (Log ROS)	70268		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.209	KM Geo Mean	9.107
KM SD (logged)	1.339	95% Critical H Value (KM-Log)	2.931
KM Standard Error of Mean (logged)	0.264	95% H-UCL (KM -Log)	46.28
KM SD (logged)	1.339	95% Critical H Value (KM-Log)	2.931
KM Standard Error of Mean (logged)	0.264		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	44.02	Mean in Log Scale	1.825
SD in Original Scale	126.1	SD in Log Scale	1.551
95% t UCL (Assumes normality)	83.15	95% H-Stat UCL	52.53

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	86.88

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	132	Number of Distinct Observations	81
		Number of Missing Observations	86
Number of Detects	129	Number of Non-Detects	3
Number of Distinct Detects	79	Number of Distinct Non-Detects	2
Minimum Detect	56	Minimum Non-Detect	47
Maximum Detect	390000	Maximum Non-Detect	7300
Variance Detects	2.876E+9	Percent Non-Detects	2.273%
Mean Detects	17420	SD Detects	53628
Median Detects	3400	CV Detects	3.078
Skewness Detects	5.202	Kurtosis Detects	28.34
Mean of Logged Detects	8.265	SD of Logged Detects	1.574

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.333	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.373	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0784	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	17063	KM Standard Error of Mean	4619
KM SD	52862	95% KM (BCA) UCL	26193
95% KM (t) UCL	24714	95% KM (Percentile Bootstrap) UCL	25074
95% KM (z) UCL	24660	95% KM Bootstrap t UCL	30113
90% KM Chebyshev UCL	30920	95% KM Chebyshev UCL	37196
97.5% KM Chebyshev UCL	45908	99% KM Chebyshev UCL	63021

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	9.505	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.836	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0875	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.433	k star (bias corrected MLE)	0.428
Theta hat (MLE)	40223	Theta star (bias corrected MLE)	40683
nu hat (MLE)	111.7	nu star (bias corrected)	110.5
Mean (detects)	17420		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	17025
Maximum	390000	Median	3350
SD	53074	CV	3.118
k hat (MLE)	0.376	k star (bias corrected MLE)	0.372
Theta hat (MLE)	45321	Theta star (bias corrected MLE)	45746
nu hat (MLE)	99.17	nu star (bias corrected)	98.25
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (98.25, α)	76.38	Adjusted Chi Square Value (98.25, β)	76.17
95% Gamma Approximate UCL (use when n>=50)	21898	95% Gamma Adjusted UCL (use when n<50)	21959

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	17063	SD (KM)	52862
Variance (KM)	2.794E+9	SE of Mean (KM)	4619
k hat (KM)	0.104	k star (KM)	0.107
nu hat (KM)	27.51	nu star (KM)	28.21
theta hat (KM)	163768	theta star (KM)	159657
80% gamma percentile (KM)	12984	90% gamma percentile (KM)	46599
95% gamma percentile (KM)	98569	99% gamma percentile (KM)	262113

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (28.21, α)	17.09	Adjusted Chi Square Value (28.21, β)	17
95% Gamma Approximate KM-UCL (use when n>=50)	28161	95% Gamma Adjusted KM-UCL (use when n<50)	28320

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.974	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.162	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0853	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0784	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	17059	Mean in Log Scale	8.222
SD in Original Scale	53064	SD in Log Scale	1.604
95% t UCL (assumes normality of ROS data)	24710	95% Percentile Bootstrap UCL	25060
95% BCA Bootstrap UCL	28125	95% Bootstrap t UCL	29899
95% H-UCL (Log ROS)	19987		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	8.219	KM Geo Mean	3712
KM SD (logged)	1.604	95% Critical H Value (KM-Log)	2.808
KM Standard Error of Mean (logged)	0.141	95% H-UCL (KM -Log)	19929
KM SD (logged)	1.604	95% Critical H Value (KM-Log)	2.808
KM Standard Error of Mean (logged)	0.141		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	17080	Mean in Log Scale	8.226
SD in Original Scale	53058	SD in Log Scale	1.618
95% t UCL (Assumes normality)	24730	95% H-Stat UCL	20606

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	19929

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	132	Number of Distinct Observations	65
		Number of Missing Observations	86
Number of Detects	72	Number of Non-Detects	60
Number of Distinct Detects	62	Number of Distinct Non-Detects	5
Minimum Detect	0.47	Minimum Non-Detect	0.45
Maximum Detect	1400	Maximum Non-Detect	4.3
Variance Detects	30528	Percent Non-Detects	45.45%
Mean Detects	46.8	SD Detects	174.7
Median Detects	1.95	CV Detects	3.733
Skewness Detects	6.86	Kurtosis Detects	52.24
Mean of Logged Detects	1.412	SD of Logged Detects	2.008

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.298	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.104	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	25.79	KM Standard Error of Mean	11.41
KM SD	130.2	95% KM (BCA) UCL	48.67
95% KM (t) UCL	44.69	95% KM (Percentile Bootstrap) UCL	46.22
95% KM (z) UCL	44.56	95% KM Bootstrap t UCL	78.07
90% KM Chebyshev UCL	60.02	95% KM Chebyshev UCL	75.53
97.5% KM Chebyshev UCL	97.05	99% KM Chebyshev UCL	139.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	7.822	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.873	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.259	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.115	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.286	k star (bias corrected MLE)	0.283
Theta hat (MLE)	163.9	Theta star (bias corrected MLE)	165.4
nu hat (MLE)	41.13	nu star (bias corrected)	40.75
Mean (detects)	46.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	25.53
Maximum	1400	Median	0.545
SD	130.7	CV	5.12
k hat (MLE)	0.166	k star (bias corrected MLE)	0.167
Theta hat (MLE)	153.9	Theta star (bias corrected MLE)	152.7
nu hat (MLE)	43.81	nu star (bias corrected)	44.15
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (44.15, α)	29.91	Adjusted Chi Square Value (44.15, β)	29.78
95% Gamma Approximate UCL (use when n>=50)	37.69	95% Gamma Adjusted UCL (use when n<50)	37.85

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	25.79	SD (KM)	130.2
Variance (KM)	16950	SE of Mean (KM)	11.41
k hat (KM)	0.0392	k star (KM)	0.0434
nu hat (KM)	10.36	nu star (KM)	11.46
theta hat (KM)	657.3	theta star (KM)	594.3
80% gamma percentile (KM)	2.027	90% gamma percentile (KM)	32.08
95% gamma percentile (KM)	129.2	99% gamma percentile (KM)	592.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (11.46, α)	4.871	Adjusted Chi Square Value (11.46, β)	4.824
95% Gamma Approximate KM-UCL (use when n>=50)	60.65	95% Gamma Adjusted KM-UCL (use when n<50)	61.25

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.865	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.0371E-8	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.104	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	25.64	Mean in Log Scale	-0.534
SD in Original Scale	130.7	SD in Log Scale	2.886
95% t UCL (assumes normality of ROS data)	44.49	95% Percentile Bootstrap UCL	45.64
95% BCA Bootstrap UCL	62.05	95% Bootstrap t UCL	79.02
95% H-UCL (Log ROS)	113.6		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.471	KM Geo Mean	1.602
KM SD (logged)	1.815	95% Critical H Value (KM-Log)	3.048
KM Standard Error of Mean (logged)	0.161	95% H-UCL (KM -Log)	13.49
KM SD (logged)	1.815	95% Critical H Value (KM-Log)	3.048
KM Standard Error of Mean (logged)	0.161		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	25.84	Mean in Log Scale	0.397
SD in Original Scale	130.7	SD in Log Scale	1.953
95% t UCL (Assumes normality)	44.68	95% H-Stat UCL	17.34

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	75.53

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	132	Number of Distinct Observations	77
		Number of Missing Observations	86
Number of Detects	131	Number of Non-Detects	1
Number of Distinct Detects	77	Number of Distinct Non-Detects	1
Minimum Detect	2.5	Minimum Non-Detect	220
Maximum Detect	15000	Maximum Non-Detect	220
Variance Detects	2731237	Percent Non-Detects	0.758%
Mean Detects	704.3	SD Detects	1653
Median Detects	280	CV Detects	2.346
Skewness Detects	6.168	Kurtosis Detects	46.06
Mean of Logged Detects	5.647	SD of Logged Detects	1.295

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.394	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.336	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0778	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	699.8	KM Standard Error of Mean	143.4
KM SD	1641	95% KM (BCA) UCL	982.7
95% KM (t) UCL	937.3	95% KM (Percentile Bootstrap) UCL	938.1
95% KM (z) UCL	935.7	95% KM Bootstrap t UCL	1163
90% KM Chebyshev UCL	1130	95% KM Chebyshev UCL	1325
97.5% KM Chebyshev UCL	1595	99% KM Chebyshev UCL	2126

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.635	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.803	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.17	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0851	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.668	k star (bias corrected MLE)	0.658
Theta hat (MLE)	1054	Theta star (bias corrected MLE)	1070
nu hat (MLE)	175.1	nu star (bias corrected)	172.5
Mean (detects)	704.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	699
Maximum	15000	Median	275
SD	1647	CV	2.357
k hat (MLE)	0.626	k star (bias corrected MLE)	0.617
Theta hat (MLE)	1116	Theta star (bias corrected MLE)	1132
nu hat (MLE)	165.4	nu star (bias corrected)	163
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (162.97, α)	134.5	Adjusted Chi Square Value (162.97, β)	134.2
95% Gamma Approximate UCL (use when n>=50)	847.3	95% Gamma Adjusted UCL (use when n<50)	849

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	699.8	SD (KM)	1641
Variance (KM)	2692550	SE of Mean (KM)	143.4
k hat (KM)	0.182	k star (KM)	0.183
nu hat (KM)	48.02	nu star (KM)	48.26
theta hat (KM)	3847	theta star (KM)	3828
80% gamma percentile (KM)	876.5	90% gamma percentile (KM)	2112
95% gamma percentile (KM)	3688	99% gamma percentile (KM)	8094

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (48.26, α)	33.32	Adjusted Chi Square Value (48.26, β)	33.18
95% Gamma Approximate KM-UCL (use when n>=50)	1014	95% Gamma Adjusted KM-UCL (use when n<50)	1018

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.984	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.676	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0656	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0778	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	699.7	Mean in Log Scale	5.639
SD in Original Scale	1647	SD in Log Scale	1.294
95% t UCL (assumes normality of ROS data)	937.2	95% Percentile Bootstrap UCL	954.4
95% BCA Bootstrap UCL	1073	95% Bootstrap t UCL	1121
95% H-UCL (Log ROS)	858.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.638	KM Geo Mean	280.9
KM SD (logged)	1.291	95% Critical H Value (KM-Log)	2.472
KM Standard Error of Mean (logged)	0.113	95% H-UCL (KM -Log)	854.6
KM SD (logged)	1.291	95% Critical H Value (KM-Log)	2.472
KM Standard Error of Mean (logged)	0.113		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	699.8	Mean in Log Scale	5.64
SD in Original Scale	1647	SD in Log Scale	1.292
95% t UCL (Assumes normality)	937.3	95% H-Stat UCL	857.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	854.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	132	Number of Distinct Observations	10
		Number of Missing Observations	86
Number of Detects	8	Number of Non-Detects	124
Number of Distinct Detects	7	Number of Distinct Non-Detects	4
Minimum Detect	0.15	Minimum Non-Detect	0.13
Maximum Detect	0.56	Maximum Non-Detect	0.32
Variance Detects	0.0165	Percent Non-Detects	93.94%
Mean Detects	0.284	SD Detects	0.128
Median Detects	0.24	CV Detects	0.452
Skewness Detects	1.635	Kurtosis Detects	3.015
Mean of Logged Detects	-1.335	SD of Logged Detects	0.401

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.849	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.139	KM Standard Error of Mean	0.00439
KM SD	0.0471	95% KM (BCA) UCL	0.147
95% KM (t) UCL	0.147	95% KM (Percentile Bootstrap) UCL	0.147
95% KM (z) UCL	0.147	95% KM Bootstrap t UCL	0.151
90% KM Chebyshev UCL	0.153	95% KM Chebyshev UCL	0.159
97.5% KM Chebyshev UCL	0.167	99% KM Chebyshev UCL	0.183

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.36	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.241	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.795	k star (bias corrected MLE)	4.33
Theta hat (MLE)	0.0418	Theta star (bias corrected MLE)	0.0655
nu hat (MLE)	108.7	nu star (bias corrected)	69.28
Mean (detects)	0.284		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0296
Maximum	0.56	Median	0.01
SD	0.0726	CV	2.456
k hat (MLE)	0.758	k star (bias corrected MLE)	0.746
Theta hat (MLE)	0.039	Theta star (bias corrected MLE)	0.0397
nu hat (MLE)	200	nu star (bias corrected)	196.8
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (196.83, α)	165.4	Adjusted Chi Square Value (196.83, β)	165.1
95% Gamma Approximate UCL (use when n>=50)	0.0352	95% Gamma Adjusted UCL (use when n<50)	0.0353

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.139	SD (KM)	0.0471
Variance (KM)	0.00222	SE of Mean (KM)	0.00439
k hat (KM)	8.744	k star (KM)	8.55
nu hat (KM)	2308	nu star (KM)	2257
theta hat (KM)	0.0159	theta star (KM)	0.0163
80% gamma percentile (KM)	0.177	90% gamma percentile (KM)	0.203
95% gamma percentile (KM)	0.226	99% gamma percentile (KM)	0.273

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (N/A, α)	2148	Adjusted Chi Square Value (N/A, β)	2147
95% Gamma Approximate KM-UCL (use when n>=50)	0.146	95% Gamma Adjusted KM-UCL (use when n<50)	0.147

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.956	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.216	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0513	Mean in Log Scale	-3.589
SD in Original Scale	0.0735	SD in Log Scale	1.112
95% t UCL (assumes normality of ROS data)	0.0619	95% Percentile Bootstrap UCL	0.0628
95% BCA Bootstrap UCL	0.0652	95% Bootstrap t UCL	0.0649
95% H-UCL (Log ROS)	0.064		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.997	KM Geo Mean	0.136
KM SD (logged)	0.192	95% Critical H Value (KM-Log)	1.692
KM Standard Error of Mean (logged)	0.0179	95% H-UCL (KM -Log)	0.142
KM SD (logged)	0.192	95% Critical H Value (KM-Log)	1.692
KM Standard Error of Mean (logged)	0.0179		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0842	Mean in Log Scale	-2.577
SD in Original Scale	0.0607	SD in Log Scale	0.371
95% t UCL (Assumes normality)	0.093	95% H-Stat UCL	0.0861

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.147

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	132	Number of Distinct Observations	63
		Number of Missing Observations	86
Number of Detects	99	Number of Non-Detects	33
Number of Distinct Detects	62	Number of Distinct Non-Detects	3
Minimum Detect	1.5	Minimum Non-Detect	1.5
Maximum Detect	310	Maximum Non-Detect	40
Variance Detects	3125	Percent Non-Detects	25%
Mean Detects	22.62	SD Detects	55.9
Median Detects	4.4	CV Detects	2.472
Skewness Detects	4.045	Kurtosis Detects	16.53
Mean of Logged Detects	1.905	SD of Logged Detects	1.311

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.408	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.353	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0893	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	17.57	KM Standard Error of Mean	4.287
KM SD	48.98	95% KM (BCA) UCL	25.08
95% KM (t) UCL	24.68	95% KM (Percentile Bootstrap) UCL	24.6
95% KM (z) UCL	24.63	95% KM Bootstrap t UCL	29.78
90% KM Chebyshev UCL	30.44	95% KM Chebyshev UCL	36.26
97.5% KM Chebyshev UCL	44.35	99% KM Chebyshev UCL	60.23

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	10.25	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.817	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.249	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.095	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.52	k star (bias corrected MLE)	0.511
Theta hat (MLE)	43.49	Theta star (bias corrected MLE)	44.25
nu hat (MLE)	103	nu star (bias corrected)	101.2
Mean (detects)	22.62		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	17.3
Maximum	310	Median	3.1
SD	49.29	CV	2.849
k hat (MLE)	0.288	k star (bias corrected MLE)	0.286
Theta hat (MLE)	60.12	Theta star (bias corrected MLE)	60.43
nu hat (MLE)	75.96	nu star (bias corrected)	75.57
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (75.57, α)	56.55	Adjusted Chi Square Value (75.57, β)	56.36
95% Gamma Approximate UCL (use when n>=50)	23.12	95% Gamma Adjusted UCL (use when n<50)	23.19

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	17.57	SD (KM)	48.98
Variance (KM)	2399	SE of Mean (KM)	4.287
k hat (KM)	0.129	k star (KM)	0.131
nu hat (KM)	33.99	nu star (KM)	34.55
theta hat (KM)	136.5	theta star (KM)	134.3
80% gamma percentile (KM)	16.9	90% gamma percentile (KM)	50.87
95% gamma percentile (KM)	99.07	99% gamma percentile (KM)	243.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (34.55, α)	22.1	Adjusted Chi Square Value (34.55, β)	21.99
95% Gamma Approximate KM-UCL (use when n>=50)	27.47	95% Gamma Adjusted KM-UCL (use when n<50)	27.61

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.858	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	8.338E-14	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.152	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0893	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	17.3	Mean in Log Scale	1.297
SD in Original Scale	49.24	SD in Log Scale	1.659
95% t UCL (assumes normality of ROS data)	24.4	95% Percentile Bootstrap UCL	24.77
95% BCA Bootstrap UCL	27.21	95% Bootstrap t UCL	28.51
95% H-UCL (Log ROS)	21.92		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.582	KM Geo Mean	4.863
KM SD (logged)	1.291	95% Critical H Value (KM-Log)	2.471
KM Standard Error of Mean (logged)	0.114	95% H-UCL (KM -Log)	14.78
KM SD (logged)	1.291	95% Critical H Value (KM-Log)	2.471
KM Standard Error of Mean (logged)	0.114		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	18.22	Mean in Log Scale	1.55
SD in Original Scale	49.1	SD in Log Scale	1.462
95% t UCL (Assumes normality)	25.3	95% H-Stat UCL	19.27

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	36.26

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Selenium

General Statistics

Total Number of Observations	132	Number of Distinct Observations	38
		Number of Missing Observations	86
Number of Detects	43	Number of Non-Detects	89
Number of Distinct Detects	33	Number of Distinct Non-Detects	6
Minimum Detect	1	Minimum Non-Detect	0.89
Maximum Detect	26	Maximum Non-Detect	5
Variance Detects	59.35	Percent Non-Detects	67.42%
Mean Detects	7.807	SD Detects	7.704
Median Detects	5.1	CV Detects	0.987
Skewness Detects	1.199	Kurtosis Detects	0.31
Mean of Logged Detects	1.531	SD of Logged Detects	1.087

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.807	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.943	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.134	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.17	KM Standard Error of Mean	0.477
KM SD	5.416	95% KM (BCA) UCL	3.947
95% KM (t) UCL	3.961	95% KM (Percentile Bootstrap) UCL	3.968
95% KM (z) UCL	3.955	95% KM Bootstrap t UCL	4.107
90% KM Chebyshev UCL	4.602	95% KM Chebyshev UCL	5.251
97.5% KM Chebyshev UCL	6.151	99% KM Chebyshev UCL	7.92

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.96	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.776	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.132	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.139	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.09	k star (bias corrected MLE)	1.03
Theta hat (MLE)	7.16	Theta star (bias corrected MLE)	7.581
nu hat (MLE)	93.78	nu star (bias corrected)	88.57
Mean (detects)	7.807		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	2.58
Maximum	26	Median	0.01
SD	5.692	CV	2.206
k hat (MLE)	0.21	k star (bias corrected MLE)	0.21
Theta hat (MLE)	12.28	Theta star (bias corrected MLE)	12.27
nu hat (MLE)	55.47	nu star (bias corrected)	55.54
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (55.54, α)	39.41	Adjusted Chi Square Value (55.54, β)	39.26
95% Gamma Approximate UCL (use when n>=50)	3.636	95% Gamma Adjusted UCL (use when n<50)	3.65

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Selenium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.17	SD (KM)	5.416
Variance (KM)	29.33	SE of Mean (KM)	0.477
k hat (KM)	0.343	k star (KM)	0.34
nu hat (KM)	90.43	nu star (KM)	89.71
theta hat (KM)	9.254	theta star (KM)	9.328
80% gamma percentile (KM)	4.993	90% gamma percentile (KM)	9.194
95% gamma percentile (KM)	13.92	99% gamma percentile (KM)	26.02

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (89.71, α)	68.87	Adjusted Chi Square Value (89.71, β)	68.67
95% Gamma Approximate KM-UCL (use when n>=50)	4.129	95% Gamma Adjusted KM-UCL (use when n<50)	4.141

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.943	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.111	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.134	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.78	Mean in Log Scale	-0.647
SD in Original Scale	5.607	SD in Log Scale	1.963
95% t UCL (assumes normality of ROS data)	3.588	95% Percentile Bootstrap UCL	3.592
95% BCA Bootstrap UCL	3.733	95% Bootstrap t UCL	3.696
95% H-UCL (Log ROS)	6.246		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.436	KM Geo Mean	1.547
KM SD (logged)	0.985	95% Critical H Value (KM-Log)	2.18
KM Standard Error of Mean (logged)	0.0875	95% H-UCL (KM -Log)	3.033
KM SD (logged)	0.985	95% Critical H Value (KM-Log)	2.18
KM Standard Error of Mean (logged)	0.0875		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.062	Mean in Log Scale	0.145
SD in Original Scale	5.509	SD in Log Scale	1.255
95% t UCL (Assumes normality)	3.856	95% H-Stat UCL	3.317

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	4.129	95% GROS Approximate Gamma UCL	3.636

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	132	Number of Distinct Observations	35
		Number of Missing Observations	86
Number of Detects	37	Number of Non-Detects	95
Number of Distinct Detects	33	Number of Distinct Non-Detects	3
Minimum Detect	0.2	Minimum Non-Detect	0.2
Maximum Detect	6.7	Maximum Non-Detect	10
Variance Detects	3.685	Percent Non-Detects	71.97%
Mean Detects	1.585	SD Detects	1.92
Median Detects	0.65	CV Detects	1.211
Skewness Detects	1.512	Kurtosis Detects	0.933
Mean of Logged Detects	-0.191	SD of Logged Detects	1.141

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.715	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.27	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.631	KM Standard Error of Mean	0.115
KM SD	1.235	95% KM (BCA) UCL	0.821
95% KM (t) UCL	0.821	95% KM (Percentile Bootstrap) UCL	0.832
95% KM (z) UCL	0.82	95% KM Bootstrap t UCL	0.88
90% KM Chebyshev UCL	0.975	95% KM Chebyshev UCL	1.131
97.5% KM Chebyshev UCL	1.348	99% KM Chebyshev UCL	1.773

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.837	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.782	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.189	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.15	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.897	k star (bias corrected MLE)	0.842
Theta hat (MLE)	1.767	Theta star (bias corrected MLE)	1.882
nu hat (MLE)	66.38	nu star (bias corrected)	62.33
Mean (detects)	1.585		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.483
Maximum	6.7	Median	0.01
SD	1.246	CV	2.579
k hat (MLE)	0.276	k star (bias corrected MLE)	0.275
Theta hat (MLE)	1.752	Theta star (bias corrected MLE)	1.76
nu hat (MLE)	72.81	nu star (bias corrected)	72.49
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (72.49, α)	53.88	Adjusted Chi Square Value (72.49, β)	53.71
95% Gamma Approximate UCL (use when n>=50)	0.65	95% Gamma Adjusted UCL (use when n<50)	0.652

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.631	SD (KM)	1.235
Variance (KM)	1.526	SE of Mean (KM)	0.115
k hat (KM)	0.261	k star (KM)	0.26
nu hat (KM)	68.85	nu star (KM)	68.62
theta hat (KM)	2.419	theta star (KM)	2.427
80% gamma percentile (KM)	0.928	90% gamma percentile (KM)	1.888
95% gamma percentile (KM)	3.018	99% gamma percentile (KM)	6.01

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (68.62, α)	50.55	Adjusted Chi Square Value (68.62, β)	50.38
95% Gamma Approximate KM-UCL (use when n>=50)	0.856	95% Gamma Adjusted KM-UCL (use when n<50)	0.859

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.936	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.125	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.144	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.499	Mean in Log Scale	-2.762
SD in Original Scale	1.227	SD in Log Scale	2.208
95% t UCL (assumes normality of ROS data)	0.676	95% Percentile Bootstrap UCL	0.687
95% BCA Bootstrap UCL	0.714	95% Bootstrap t UCL	0.739
95% H-UCL (Log ROS)	1.425		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.168	KM Geo Mean	0.311
KM SD (logged)	0.908	95% Critical H Value (KM-Log)	2.113
KM Standard Error of Mean (logged)	0.0844	95% H-UCL (KM -Log)	0.556
KM SD (logged)	0.908	95% Critical H Value (KM-Log)	2.113
KM Standard Error of Mean (logged)	0.0844		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1	Mean in Log Scale	-1.317
SD in Original Scale	1.789	SD in Log Scale	1.472
95% t UCL (Assumes normality)	1.258	95% H-Stat UCL	1.114

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.556

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	132	Number of Distinct Observations	39
		Number of Missing Observations	86
Number of Detects	50	Number of Non-Detects	82
Number of Distinct Detects	36	Number of Distinct Non-Detects	5
Minimum Detect	0.82	Minimum Non-Detect	0.82
Maximum Detect	260	Maximum Non-Detect	7.5
Variance Detects	2422	Percent Non-Detects	62.12%
Mean Detects	25.64	SD Detects	49.21
Median Detects	4.95	CV Detects	1.92
Skewness Detects	3.193	Kurtosis Detects	11.25
Mean of Logged Detects	1.99	SD of Logged Detects	1.575

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.555	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.125	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	10.3	KM Standard Error of Mean	2.839
KM SD	32.29	95% KM (BCA) UCL	14.8
95% KM (t) UCL	15	95% KM (Percentile Bootstrap) UCL	15.32
95% KM (z) UCL	14.97	95% KM Bootstrap t UCL	18.3
90% KM Chebyshev UCL	18.82	95% KM Chebyshev UCL	22.68
97.5% KM Chebyshev UCL	28.03	99% KM Chebyshev UCL	38.55

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.587	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.814	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.192	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.132	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.506	k star (bias corrected MLE)	0.489
Theta hat (MLE)	50.68	Theta star (bias corrected MLE)	52.45
nu hat (MLE)	50.58	nu star (bias corrected)	48.88
Mean (detects)	25.64		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	9.77
Maximum	260	Median	0.01
SD	32.57	CV	3.334
k hat (MLE)	0.173	k star (bias corrected MLE)	0.175
Theta hat (MLE)	56.33	Theta star (bias corrected MLE)	55.97
nu hat (MLE)	45.79	nu star (bias corrected)	46.09
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (46.09, α)	31.51	Adjusted Chi Square Value (46.09, β)	31.38
95% Gamma Approximate UCL (use when n>=50)	14.29	95% Gamma Adjusted UCL (use when n<50)	14.35

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	10.3	SD (KM)	32.29
Variance (KM)	1043	SE of Mean (KM)	2.839
k hat (KM)	0.102	k star (KM)	0.104
nu hat (KM)	26.86	nu star (KM)	27.58
theta hat (KM)	101.2	theta star (KM)	98.59
80% gamma percentile (KM)	7.6	90% gamma percentile (KM)	27.89
95% gamma percentile (KM)	59.6	99% gamma percentile (KM)	160

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (27.58, α)	16.6	Adjusted Chi Square Value (27.58, β)	16.51
95% Gamma Approximate KM-UCL (use when n>=50)	17.11	95% Gamma Adjusted KM-UCL (use when n<50)	17.21

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.947	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.142	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.125	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	9.925	Mean in Log Scale	-0.659
SD in Original Scale	32.52	SD in Log Scale	2.688
95% t UCL (assumes normality of ROS data)	14.61	95% Percentile Bootstrap UCL	14.74
95% BCA Bootstrap UCL	16.71	95% Bootstrap t UCL	17.91
95% H-UCL (Log ROS)	50.52		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.678	KM Geo Mean	1.969
KM SD (logged)	1.423	95% Critical H Value (KM-Log)	2.61
KM Standard Error of Mean (logged)	0.127	95% H-UCL (KM -Log)	7.502
KM SD (logged)	1.423	95% Critical H Value (KM-Log)	2.61
KM Standard Error of Mean (logged)	0.127		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	10.47	Mean in Log Scale	0.553
SD in Original Scale	32.38	SD in Log Scale	1.658
95% t UCL (Assumes normality)	15.14	95% H-Stat UCL	10.42

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	22.68

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	132	Number of Distinct Observations	71
		Number of Missing Observations	86
Number of Detects	94	Number of Non-Detects	38
Number of Distinct Detects	69	Number of Distinct Non-Detects	5
Minimum Detect	17	Minimum Non-Detect	15
Maximum Detect	5500	Maximum Non-Detect	310
Variance Detects	1032748	Percent Non-Detects	28.79%
Mean Detects	782.9	SD Detects	1016
Median Detects	365	CV Detects	1.298
Skewness Detects	2.618	Kurtosis Detects	7.599
Mean of Logged Detects	6.037	SD of Logged Detects	1.169

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.673	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.24	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.0916	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	563.1	KM Standard Error of Mean	80.55
KM SD	920.5	95% KM (BCA) UCL	701.8
95% KM (t) UCL	696.5	95% KM (Percentile Bootstrap) UCL	702.1
95% KM (z) UCL	695.6	95% KM Bootstrap t UCL	725.4
90% KM Chebyshev UCL	804.7	95% KM Chebyshev UCL	914.2
97.5% KM Chebyshev UCL	1066	99% KM Chebyshev UCL	1365

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.182	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.786	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.136	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.0953	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.93	k star (bias corrected MLE)	0.907
Theta hat (MLE)	842	Theta star (bias corrected MLE)	862.9
nu hat (MLE)	174.8	nu star (bias corrected)	170.6
Mean (detects)	782.9		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	557.5
Maximum	5500	Median	245
SD	927.2	CV	1.663
k hat (MLE)	0.217	k star (bias corrected MLE)	0.217
Theta hat (MLE)	2571	Theta star (bias corrected MLE)	2569
nu hat (MLE)	57.26	nu star (bias corrected)	57.29
Adjusted Level of Significance (β)	0.0482		
Approximate Chi Square Value (57.29, α)	40.89	Adjusted Chi Square Value (57.29, β)	40.74
95% Gamma Approximate UCL (use when n>=50)	781.1	95% Gamma Adjusted UCL (use when n<50)	784

Table B.20.2

Summary of ProUCL Output for OU1 Groundwater (Upper & Lower Aquifers)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/3/2019 3:04:17 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	563.1	SD (KM)	920.5
Variance (KM)	847263	SE of Mean (KM)	80.55
k hat (KM)	0.374	k star (KM)	0.371
nu hat (KM)	98.79	nu star (KM)	97.88
theta hat (KM)	1505	theta star (KM)	1519
80% gamma percentile (KM)	899.8	90% gamma percentile (KM)	1611
95% gamma percentile (KM)	2401	99% gamma percentile (KM)	4404

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (97.88, α)	76.06	Adjusted Chi Square Value (97.88, β)	75.85
95% Gamma Approximate KM-UCL (use when n>=50)	724.6	95% Gamma Adjusted KM-UCL (use when n<50)	726.7

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.964	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	0.059	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.0681	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.0916	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	568.7	Mean in Log Scale	5.296
SD in Original Scale	920.7	SD in Log Scale	1.574
95% t UCL (assumes normality of ROS data)	701.4	95% Percentile Bootstrap UCL	705.2
95% BCA Bootstrap UCL	727.5	95% Bootstrap t UCL	745.1
95% H-UCL (Log ROS)	1007		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.106	KM Geo Mean	165
KM SD (logged)	1.774	95% Critical H Value (KM-Log)	3
KM Standard Error of Mean (logged)	0.156	95% H-UCL (KM -Log)	1268
KM SD (logged)	1.774	95% Critical H Value (KM-Log)	3
KM Standard Error of Mean (logged)	0.156		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	564.9	Mean in Log Scale	5.121
SD in Original Scale	922.9	SD in Log Scale	1.805
95% t UCL (Assumes normality)	698	95% H-Stat UCL	1378

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	1268

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.1

Summary of ProUCL Input Data for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	8	9	10	11	16	17	20	21
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	1,1-Dichloroethane	D_1,1-Dichloroethane	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzene	D_Benzene	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	Ethylbenzene	D_Ethylbenzene
OU1	BH1-13	6/13/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH01-18	5/8/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	BH2-13	6/14/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH02-18	5/8/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	BH3-13	6/14/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH03-18	5/7/2018	Upper Aquifer	1.8	1	0.23	0	0.28	0	0.31	0	0.26	0
OU1	BH4-13	6/14/2013	Upper Aquifer	1	0	1	0	0.4	1	1.3	1	1.2	1
OU1	BH04-18	5/8/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	BH5-13	6/14/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH05-18	5/10/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	BH6-13	6/13/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH06-18	5/10/2018	Upper Aquifer	0.3	1	1.4	1	0.28	0	0.31	0	0.26	0
OU1	BH7-13	6/12/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH07-18	5/10/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	BH8-13	6/13/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH08-18	5/11/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	BH9-13	6/11/2013	Upper Aquifer	0.27	1	1	0	0.17	1	1	0	1	0
OU1	BH09-18	5/14/2018	Upper Aquifer	0.25	0	0.23	0	0.28	1	0.31	0	0.26	0
OU1	BH10-13	6/11/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH10-18	5/11/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	BH11-13	6/11/2013	Upper Aquifer	0.31	1	1	0	1	0	1	0	1	0
OU1	BH12-13	6/11/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH13-13	6/12/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH14-13	6/11/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH14-18	9/17/2018	Upper Aquifer	1.6	1	0.16	0	0.45	1	0.13	0	0.4	1
OU1	BH15-13	6/12/2013	Upper Aquifer	0.2	1	1	0	1	0	1	0	1	0
OU1	BH16-13	6/12/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH16-13	7/10/2013	Upper Aquifer	2	0	2	0	2	0	2	0	2	0
OU1	BH17-13	6/12/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH17-13	7/10/2013	Upper Aquifer	2.9	0	2.9	0	2.9	0	2.9	0	2.9	0
OU1	BH18-13	6/12/2013	Upper Aquifer	0.22	1	1	0	1	0	1	0	1	0
OU1	BH18-13	7/9/2013	Upper Aquifer	0.25	1	1	0	1	0	1	0	1	0
OU1	BH19-13	6/13/2013	Upper Aquifer	0.23	1	1	0	1	0	1	0	1	0
OU1	BH20-13	6/17/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH20-18	5/15/2018	Upper Aquifer	0.25	0	0.44	1	0.28	0	0.31	0	0.26	0
OU1	BH21-13	6/17/2013	Upper Aquifer	0.45	1	1	0	1	0	1	0	1	0
OU1	BH22-13	6/17/2013	Upper Aquifer	0.24	1	1	0	1	0	1	0	1	0
OU1	BH23-13	6/18/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH24-13	6/18/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH25-13	6/18/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH30-13	7/3/2013	Upper Aquifer	1.4	0	1.4	0	0.19	1	1.4	0	1.4	0
OU1	BH31-13	7/1/2013	Upper Aquifer	2	0	2	0	0.31	1	2	0	2	0
OU1	BH32-13	7/2/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH33-13	6/27/2013	Upper Aquifer	5	0	5	0	80	1	5	0	100	1
OU1	BH34-13	6/27/2013	Upper Aquifer	1	0	1	0	0.49	1	1	0	1	0
OU1	BH35-13	6/28/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH36-13	7/2/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH37-13	7/3/2013	Upper Aquifer	0.44	1	1	0	0.63	1	1	0	1	0
OU1	BH38-13	6/28/2013	Upper Aquifer	0.99	1	1	0	0.48	1	1	0	0.46	1
OU1	BH39-13	7/1/2013	Upper Aquifer	0.37	1	1	0	1	0	1	0	1	0
OU1	BH40-13	7/2/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH42-13	7/8/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH43-13	7/2/2013	Upper Aquifer	4	1	1	0	0.15	1	1	0	1	0
OU1	BH44-13	7/2/2013	Upper Aquifer	0.53	1	1	0	1	0	1	0	1	0
OU1	BH46-13	7/2/2013	Upper Aquifer	11	0	11	0	100	1	11	0	9.9	1
OU1	BH46B-13	7/3/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH48B-13	7/8/2013	Upper Aquifer	0.18	1	1	0	0.61	1	1	0	1	0

Table B.21.1

Summary of ProUCL Input Data for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	8	9	10	11	16	17	20	21
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	1,1-Dichloroethane	D_1,1-Dichloroethane	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzene	D_Benzene	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	Ethylbenzene	D_Ethylbenzene
OU1	BH49-13	6/18/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH51-13	6/21/2013	Upper Aquifer	1	0	1	0	1	0	1	0	0.84	1
OU1	BH52-13	6/19/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH53-13	6/18/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH54-13	6/18/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH55-13	6/18/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH56-13	6/19/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH57-13	6/19/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH58-13	6/19/2013	Upper Aquifer	1	0	1	0	1	0	1	0	0.68	1
OU1	BH59-13	6/19/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH60-13	6/19/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH61-13	6/19/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH62-13	6/19/2013	Upper Aquifer	1	0	1	0	1	0	1	0	0.86	1
OU1	BH63-13	6/20/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH64-13	6/19/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH65-13	6/20/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH66-13	6/26/2013	Upper Aquifer	0.53	1	1	0	1	0	1	0	0.39	1
OU1	BH67-13	6/20/2013	Upper Aquifer	0.55	1	1	0	1	0	1	0	0.67	1
OU1	BH68-13	6/20/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH69-13	6/21/2013	Upper Aquifer	1.7	0	1.7	0	1.7	0	0.48	1	1.7	0
OU1	BH70-13	6/21/2013	Upper Aquifer	2	0	2	0	2	0	0.57	1	2	0
OU1	BH71-13	6/20/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH72-13	6/20/2013	Upper Aquifer	1	0	2.5	1	0.79	1	1	0	1	0
OU1	BH73-13	6/20/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH74-13	6/20/2013	Upper Aquifer	1	0	1	0	1	0	1	0	0.59	1
OU1	BH75-13	6/25/2013	Upper Aquifer	1	0	0.28	1	0.49	1	1	0	1	0
OU1	BH76-13	6/26/2013	Upper Aquifer	1	0	1	0	0.89	1	1	0	1	0
OU1	BH77-13	6/25/2013	Upper Aquifer	1.4	0	5.6	1	12	1	1.4	0	2.2	1
OU1	BH78-13	6/25/2013	Upper Aquifer	0.62	1	0.2	1	0.2	1	1	0	0.27	1
OU1	BH79-13	6/26/2013	Upper Aquifer	0.25	1	0.5	1	0.25	1	1	0	1	0
OU1	BH80-13	6/25/2013	Upper Aquifer	0.33	1	1	1	0.23	1	1	0	1	0
OU1	BH81-13	6/27/2013	Upper Aquifer	0.41	1	0.27	1	0.33	1	1	0	1	0
OU1	BH82-13	6/25/2013	Upper Aquifer	0.47	1	1	0	1	0	1	0	1	0
OU1	BH83-13	6/25/2013	Upper Aquifer	1	0	0.43	1	0.31	1	1	0	1	0
OU1	BH84-13	6/26/2013	Upper Aquifer	1.7	1	1	0	0.37	1	1	0	1	0
OU1	BH85-13	6/25/2013	Upper Aquifer	0.35	1	0.48	1	1	0	1	0	1	0
OU1	BH86-13	6/24/2013	Upper Aquifer	2.2	0	2.2	0	0.3	1	2.2	0	2.2	0
OU1	BH87-13	6/26/2013	Upper Aquifer	0.23	1	1	0	0.29	1	1	0	1	0
OU1	BH88-13	6/24/2013	Upper Aquifer	1	0	1	0	0.67	1	1	0	1	0
OU1	BH89-13	6/24/2013	Upper Aquifer	0.62	1	1	0	0.21	1	1	0	1	0
OU1	BH90-13	7/9/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH91-13	6/28/2013	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	BH92-13	7/9/2013	Upper Aquifer	5.2	1	1	0	0.55	1	1	0	0.39	1
OU1	BH93-13	7/9/2013	Upper Aquifer	1	0	1	0	0.62	1	1	0	1	0
OU1	MW-101A	5/13/2015	Upper Aquifer	0.44	1	1	0	1	0	1	0	1	0
OU1	MW-202	5/12/2015	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	MW-203	5/13/2015	Upper Aquifer	0.32	1	1	0	1	0	1	0	1	0
OU1	MW-204	5/11/2015	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	MW-208	10/4/2017	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	MW-209	5/12/2015	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	MW-209	10/17/2018	Upper Aquifer	0.17	0	0.16	0	0.13	0	0.13	0	0.11	0
OU1	MW-210	5/15/2015	Upper Aquifer	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0
OU1	MW-210	10/3/2017	Upper Aquifer	0.5	0	0.46	0	0.56	0	0.62	0	0.52	0
OU1	MW-210	10/6/2017	Upper Aquifer										
OU1	MW-212	5/12/2015	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	MW-212	10/17/2018	Upper Aquifer	0.17	0	0.16	0	0.13	0	0.13	0	0.11	0
OU1	MW-215A	5/13/2015	Upper Aquifer	1	0	0.37	1	2.8	1	1	0	0.48	1

Table B.21.1

Summary of ProUCL Input Data for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	8	9	10	11	16	17	20	21
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	1,1-Dichloroethane	D_1,1-Dichloroethane	1,4-Dichlorobenzene	D_1,4-Dichlorobenzene	Benzene	D_Benzene	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	Ethylbenzene	D_Ethylbenzene
OU1	MW-217	10/17/2018	Upper Aquifer	0.17	0	0.16	0	0.13	0	0.13	0	0.11	0
OU1	MW-219	5/13/2015	Upper Aquifer	1	0	1	0	1	0	1	0	1	0
OU1	MW-225	10/5/2017	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.59	1	0.26	0
OU1	MW-227	10/4/2017	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	MW-229	5/14/2015	Upper Aquifer	2.5	0	2.5	0	2.5	0	2.5	0	2.5	0
OU1	MW-230	10/17/2018	Upper Aquifer	0.17	0	0.16	1	4.4	1	0.13	0	0.11	0
OU1	MW-233	10/18/2018	Upper Aquifer	0.17	0	0.16	0	0.13	0	0.13	0	0.11	0
OU1	MW-235	10/18/2018	Upper Aquifer	11	0	11	0	8.7	0	8.7	0	7.3	0
OU1	VAS-31	1/19/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-31	1/19/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-31	1/22/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-31	1/22/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-32	1/8/2018	Upper Aquifer	0.25	0	0.23	0	0.63	1	0.31	0	0.35	1
OU1	VAS-32	1/8/2018	Upper Aquifer	2.5	0	2.3	0	2.8	0	3.1	0	2.6	0
OU1	VAS-32	1/8/2018	Upper Aquifer	8.3	0	7.7	0	9.3	0	10	0	8.7	0
OU1	VAS-32	1/8/2018	Upper Aquifer	1.3	0	1.2	0	1.4	0	1.6	0	1.3	0
OU1	VAS-33	1/10/2018	Upper Aquifer	0.25	0	0.45	1	0.28	0	0.31	0	0.26	0
OU1	VAS-33	1/10/2018	Upper Aquifer	0.3	1	0.23	0	0.32	1	0.31	0	0.26	0
OU1	VAS-33	1/10/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-33	1/10/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-33	1/11/2018	Upper Aquifer	0.28	1	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-33	1/11/2018	Upper Aquifer	0.36	0	0.33	0	0.4	0	0.44	0	0.37	0
OU1	VAS-34	2/16/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.7	1	0.26	0
OU1	VAS-34	2/16/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.6	1	0.26	0
OU1	VAS-34	2/19/2018	Upper Aquifer	0.63	0	0.58	0	0.71	1	0.78	0	0.65	0
OU1	VAS-34	2/19/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-34	2/20/2018	Upper Aquifer	0.28	1	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-37	9/18/2018	Upper Aquifer	1.5	1	0.64	0	1.1	1	0.52	0	4.5	1
OU1	VAS-38	2/7/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-38	2/7/2018	Upper Aquifer	0.48	1	0.23	0	0.28	0	0.32	1	0.26	0
OU1	VAS-38	2/7/2018	Upper Aquifer	2	1	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-38	2/7/2018	Upper Aquifer	0.72	1	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-38	2/8/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-38	2/8/2018	Upper Aquifer	13	1	5.8	0	7	0	7.8	0	6.5	0
OU1	VAS-38	2/8/2018	Upper Aquifer	23	1	9.2	0	11	0	12	0	10	0
OU1	VAS-38	2/9/2018	Upper Aquifer	1.1	1	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-44	1/25/2018	Upper Aquifer	0.25	0	0.23	0	0.47	1	0.31	0	0.26	0
OU1	VAS-44	1/26/2018	Upper Aquifer	0.25	0	0.23	0	0.83	1	0.31	0	0.37	1
OU1	VAS-44	1/29/2018	Upper Aquifer	0.25	0	0.23	0	0.28	0	0.31	0	0.26	0
OU1	VAS-44	1/29/2018	Upper Aquifer	6.3	0	5.8	0	7	0	7.8	0	6.5	0
OU1	VAS-44	1/29/2018	Upper Aquifer	0.25	0	0.23	0	0.98	1	0.39	1	0.26	0
OU1	VAS-44	1/30/2018	Upper Aquifer	0.25	0	0.23	0	0.49	1	0.31	0	0.26	0

Table B.21.1

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Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				26	27	28	29	30	31	36	37	56	57	64	65
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Xylenes (total)	D_Xylenes (total)	Naphthalene	D_Naphthalene	Cyanide (total)	D_Cyanide (total)	Mercury	D_Mercury
OU1	BH1-13	6/13/2013	Upper Aquifer	1.4	1	1	0	2	0	1	0			0.2	0
OU1	BH01-18	5/8/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0					0.13	0
OU1	BH2-13	6/14/2013	Upper Aquifer	0.71	1	1	0	2	0	1	0			0.2	0
OU1	BH02-18	5/8/2018	Upper Aquifer	0.52	0	0.45	0	0.24	0					0.13	0
OU1	BH3-13	6/14/2013	Upper Aquifer	0.43	1	1	0	2	0	1	0				
OU1	BH03-18	5/7/2018	Upper Aquifer	12	1	0.45	0	0.24	0					0.13	0
OU1	BH4-13	6/14/2013	Upper Aquifer	1.9	1	1	0	4.4	1	1	0			0.2	0
OU1	BH04-18	5/8/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0					0.13	0
OU1	BH5-13	6/14/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH05-18	5/10/2018	Upper Aquifer	0.53	1	0.45	0	0.24	0					0.13	0
OU1	BH6-13	6/13/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH06-18	5/10/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0					0.13	0
OU1	BH7-13	6/12/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH07-18	5/10/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0					0.13	0
OU1	BH8-13	6/13/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH08-18	5/11/2018	Upper Aquifer	4.1	1	0.45	0	0.24	0	0.063	0	390	1	0.13	0
OU1	BH9-13	6/11/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH09-18	5/14/2018	Upper Aquifer	0.33	0	15	1	0.24	0	0.064	0	12	0	0.13	0
OU1	BH10-13	6/11/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH10-18	5/11/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0	0.065	0	10	0	0.13	0
OU1	BH11-13	6/11/2013	Upper Aquifer	1	0	1	0	2	0	1	0			0.2	0
OU1	BH12-13	6/11/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH13-13	6/12/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH14-13	6/11/2013	Upper Aquifer	0.27	1	1	0	2	0	1	0				
OU1	BH14-18	9/17/2018	Upper Aquifer	4.3	1	1.9	1	1	1	0.33	1	6	0	0.32	0
OU1	BH15-13	6/12/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH16-13	6/12/2013	Upper Aquifer	0.96	1	1	0	2	0	1	0				
OU1	BH16-13	7/10/2013	Upper Aquifer	78	1	2	0	4	0	2	0				
OU1	BH17-13	6/12/2013	Upper Aquifer	0.56	1	1	0	2	0	1	0				
OU1	BH17-13	7/10/2013	Upper Aquifer	94	1	2.9	0	5.7	0	2.9	0				
OU1	BH18-13	6/12/2013	Upper Aquifer	3.4	1	1	0	2	0	1	0			0.2	0
OU1	BH18-13	7/9/2013	Upper Aquifer	8.8	1	1	0	2	0	1	0			0.2	0
OU1	BH19-13	6/13/2013	Upper Aquifer	1.8	1	1	0	2	0	1	0				
OU1	BH20-13	6/17/2013	Upper Aquifer	1.8	1	1	0	2	0	1	0				
OU1	BH20-18	5/15/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0	0.1	0	6	0	0.13	0
OU1	BH21-13	6/17/2013	Upper Aquifer	1	1	1	0	2	0	1	0				
OU1	BH22-13	6/17/2013	Upper Aquifer	0.72	1	1	0	2	0	1	0			0.2	0
OU1	BH23-13	6/18/2013	Upper Aquifer	0.79	1	1	0	2	0	1	0				
OU1	BH24-13	6/18/2013	Upper Aquifer	2	1	1	0	2	0	1	0				
OU1	BH25-13	6/18/2013	Upper Aquifer	1.3	1	1	0	2	0	1	0			0.2	0
OU1	BH30-13	7/3/2013	Upper Aquifer	39	1	1.4	0	2.9	0	1.4	0			0.2	0
OU1	BH31-13	7/1/2013	Upper Aquifer	57	1	9.4	1	4	0	2	0				
OU1	BH32-13	7/2/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH33-13	6/27/2013	Upper Aquifer	5	0	1.1	1	190	1	5.1	1				
OU1	BH34-13	6/27/2013	Upper Aquifer	1	0	11	1	2	0	1	0				
OU1	BH35-13	6/28/2013	Upper Aquifer	1	0	2.2	1	2	0	1	0				
OU1	BH36-13	7/2/2013	Upper Aquifer	1	0	2.3	1	2	0	1	0			0.2	0
OU1	BH37-13	7/3/2013	Upper Aquifer	1	0	7.7	1	2	0	1	0				
OU1	BH38-13	6/28/2013	Upper Aquifer	1	0	1.9	1	2.2	1	1	0				
OU1	BH39-13	7/1/2013	Upper Aquifer	1	1	3.6	1	2	0	1	0				
OU1	BH40-13	7/2/2013	Upper Aquifer	0.56	1	0.25	1	2	0	1	0			0.2	0
OU1	BH42-13	7/8/2013	Upper Aquifer	1	0	3.5	1	2	0	1.4	1				
OU1	BH43-13	7/2/2013	Upper Aquifer	6.1	1	6.2	1	2	0	1	0				
OU1	BH44-13	7/2/2013	Upper Aquifer	1.9	1	0.28	1	2	0	1	0				
OU1	BH46-13	7/2/2013	Upper Aquifer	11	0	11	0	36	1	11	0			0.2	0
OU1	BH46B-13	7/3/2013	Upper Aquifer	1	0	1	0	2	0	1	0			0.2	0
OU1	BH48B-13	7/8/2013	Upper Aquifer	1	0	2.9	1	2	0	1	0			0.2	0

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South Dayton Dump Site
Moraine, Ohio

				26	27	28	29	30	31	36	37	56	57	64	65
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Xylenes (total)	D_Xylenes (total)	Naphthalene	D_Naphthalene	Cyanide (total)	D_Cyanide (total)	Mercury	D_Mercury
OU1	BH49-13	6/18/2013	Upper Aquifer	1	0	1	0	2	0	1	0			0.2	0
OU1	BH51-13	6/21/2013	Upper Aquifer	1	0	1	0	6.3	1	0.32	1				
OU1	BH52-13	6/19/2013	Upper Aquifer	0.4	1	0.73	1	2	0	1	0				
OU1	BH53-13	6/18/2013	Upper Aquifer	2	1	1	0	2	0	1	0				
OU1	BH54-13	6/18/2013	Upper Aquifer	0.58	1	1	0	2	0	1	0				
OU1	BH55-13	6/18/2013	Upper Aquifer	2.1	1	0.46	1	2	0	1	0				
OU1	BH56-13	6/19/2013	Upper Aquifer	0.71	1	1	0	2	0	1	0				
OU1	BH57-13	6/19/2013	Upper Aquifer	0.95	1	0.48	1	2	0	1	0				
OU1	BH58-13	6/19/2013	Upper Aquifer	1	0	1	0	4.7	1	1	0				
OU1	BH59-13	6/19/2013	Upper Aquifer	1.6	1	1	0	2	0	1	0				
OU1	BH60-13	6/19/2013	Upper Aquifer	1.3	1	1	0	2	0	1	0				
OU1	BH61-13	6/19/2013	Upper Aquifer	0.8	1	1	0	2	0	1	0				
OU1	BH62-13	6/19/2013	Upper Aquifer	1	0	1	0	7.3	1	0.43	1				
OU1	BH63-13	6/20/2013	Upper Aquifer	0.7	1	1	0	2	0	1	0				
OU1	BH64-13	6/19/2013	Upper Aquifer	1.1	1	1	0	2	0	1	0				
OU1	BH65-13	6/20/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH66-13	6/26/2013	Upper Aquifer	1	0	0.29	1	0.64	1	1	0				
OU1	BH67-13	6/20/2013	Upper Aquifer	1	0	0.57	1	0.3	1	1	0				
OU1	BH68-13	6/20/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH69-13	6/21/2013	Upper Aquifer	43	1	1.7	0	3.3	0	1.7	0				
OU1	BH70-13	6/21/2013	Upper Aquifer	74	1	2	0	4	0	2	0				
OU1	BH71-13	6/20/2013	Upper Aquifer	0.24	1	1	0	2	0	1	0				
OU1	BH72-13	6/20/2013	Upper Aquifer	0.17	1	1	0	0.53	1	1	0				
OU1	BH73-13	6/20/2013	Upper Aquifer	2.6	1	1	0	2	0	1	0				
OU1	BH74-13	6/20/2013	Upper Aquifer	0.8	1	1	0	4.1	1	1	0				
OU1	BH75-13	6/25/2013	Upper Aquifer	1	0	0.34	1	2	0	1	0				
OU1	BH76-13	6/26/2013	Upper Aquifer	1	0	1	0	0.35	1	1	0			0.2	0
OU1	BH77-13	6/25/2013	Upper Aquifer	1.4	0	0.32	1	5.7	1	9.8	1				
OU1	BH78-13	6/25/2013	Upper Aquifer	0.38	1	0.41	1	0.85	1	1	0				
OU1	BH79-13	6/26/2013	Upper Aquifer	1	0	5.3	1	2	0	1	0				
OU1	BH80-13	6/25/2013	Upper Aquifer	1	0	0.41	1	2	0	1	0				
OU1	BH81-13	6/27/2013	Upper Aquifer	0.17	1	0.44	1	2	0	1	0			0.2	0
OU1	BH82-13	6/25/2013	Upper Aquifer	1	0	1.9	1	2	0	1	0				
OU1	BH83-13	6/25/2013	Upper Aquifer	1	0	2.2	1	2	0	1	0				
OU1	BH84-13	6/26/2013	Upper Aquifer	0.54	1	0.31	1	2	0	1	0				
OU1	BH85-13	6/25/2013	Upper Aquifer	1	0	1	0	2	0	1.3	1			0.2	0
OU1	BH86-13	6/24/2013	Upper Aquifer	2.2	0	54	1	4.4	0	2.2	0				
OU1	BH87-13	6/26/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH88-13	6/24/2013	Upper Aquifer	1	0	2.5	1	2	0	1	0				
OU1	BH89-13	6/24/2013	Upper Aquifer	11	1	7	1	2	0	1	0			0.2	0
OU1	BH90-13	7/9/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH91-13	6/28/2013	Upper Aquifer	1	0	1	0	2	0	1	0				
OU1	BH92-13	7/9/2013	Upper Aquifer	1	0	1	0	0.75	1	4.9	1				
OU1	BH93-13	7/9/2013	Upper Aquifer	1	0	1	0	2	0	1.2	1				
OU1	MW-101A	5/13/2015	Upper Aquifer	1	0	1.7	1	2	0						
OU1	MW-202	5/12/2015	Upper Aquifer	2.3	1	1	0	2	0						
OU1	MW-203	5/13/2015	Upper Aquifer	1.1	1	1.6	1	2	0						
OU1	MW-204	5/11/2015	Upper Aquifer	1	0	1	0	2	0						
OU1	MW-208	10/4/2017	Upper Aquifer	1.4	1	0.45	0	0.24	0	0.061	0	86	1	0.13	0
OU1	MW-209	5/12/2015	Upper Aquifer	1	0	1	1	2	0						
OU1	MW-209	10/17/2018	Upper Aquifer	0.1	0	0.2	0	0.15	0	0.1	0	6	0	0.13	0
OU1	MW-210	5/15/2015	Upper Aquifer	78	1	2.5	0	5	0						
OU1	MW-210	10/3/2017	Upper Aquifer	47	1	0.9	0	0.48	0	0.063	0	5	0		
OU1	MW-210	10/6/2017	Upper Aquifer											0.13	0
OU1	MW-212	5/12/2015	Upper Aquifer	1	0	1	0	2	0						
OU1	MW-212	10/17/2018	Upper Aquifer	0.1	0	0.2	0	0.15	0	0.1	0	6	0	0.13	0
OU1	MW-215A	5/13/2015	Upper Aquifer	1	0	0.31	1	2	0						

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				26	27	28	29	30	31	36	37	56	57	64	65
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride	Xylenes (total)	D_Xylenes (total)	Naphthalene	D_Naphthalene	Cyanide (total)	D_Cyanide (total)	Mercury	D_Mercury
OU1	MW-217	10/17/2018	Upper Aquifer	0.1	0	0.2	0	0.15	0	0.11	0	6	0	0.13	0
OU1	MW-219	5/13/2015	Upper Aquifer	1	0	1	0	2	0						
OU1	MW-225	10/5/2017	Upper Aquifer	0.33	0	0.45	0	0.24	0	0.06	0	5	0	0.13	0
OU1	MW-227	10/4/2017	Upper Aquifer	0.33	0	0.45	0	0.24	0	0.063	0	5	0	0.13	0
OU1	MW-229	5/14/2015	Upper Aquifer	85	1	2.5	0	5	0						
OU1	MW-230	10/17/2018	Upper Aquifer	0.1	0	0.2	0	0.4	1	0.11	0	6	0	0.13	0
OU1	MW-233	10/18/2018	Upper Aquifer	1.9	1	0.2	0	0.15	0	0.1	0	6	0	0.13	0
OU1	MW-235	10/18/2018	Upper Aquifer	6.7	0	620	1	10	0	0.1	0	28	1	0.13	0
OU1	VAS-31	1/19/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0	0.06	0	6	0	0.13	0
OU1	VAS-31	1/19/2018	Upper Aquifer	8.3	1	0.45	0	0.24	0					0.13	0
OU1	VAS-31	1/22/2018	Upper Aquifer	3	1	0.45	0	0.24	0					0.13	0
OU1	VAS-31	1/22/2018	Upper Aquifer	2.8	1	0.45	0	0.24	0	0.061	0	6	0	0.13	0
OU1	VAS-32	1/8/2018	Upper Aquifer	0.33	0	4	1	1.4	1	0.06	0	7.4	1	0.13	0
OU1	VAS-32	1/8/2018	Upper Aquifer	3.3	0	75	1	2.4	0					0.13	0
OU1	VAS-32	1/8/2018	Upper Aquifer	11	0	400	1	8	0					0.13	0
OU1	VAS-32	1/8/2018	Upper Aquifer	1.7	0	11	1	1.2	0	0.061	0	7.8	1	0.3	1
OU1	VAS-33	1/10/2018	Upper Aquifer	0.33	0	1.6	1	0.24	0	0.063	0	150	1	0.13	0
OU1	VAS-33	1/10/2018	Upper Aquifer	0.48	1	15	1	0.24	0					0.24	1
OU1	VAS-33	1/10/2018	Upper Aquifer	0.33	0	9.5	1	0.24	0					0.13	0
OU1	VAS-33	1/10/2018	Upper Aquifer	0.38	1	4.5	1	0.24	0					0.13	0
OU1	VAS-33	1/11/2018	Upper Aquifer	0.33	0	6.3	1	0.24	0	0.063	0	6	0	0.13	0
OU1	VAS-33	1/11/2018	Upper Aquifer	0.47	0	6.8	1	0.34	0					0.13	0
OU1	VAS-34	2/16/2018	Upper Aquifer	7	1	0.45	0	0.24	0	0.06	0	580	1	0.13	0
OU1	VAS-34	2/16/2018	Upper Aquifer	18	1	0.45	0	0.24	0					0.13	0
OU1	VAS-34	2/19/2018	Upper Aquifer	57	1	1.1	0	0.6	0					0.13	0
OU1	VAS-34	2/19/2018	Upper Aquifer	21	1	0.45	0	0.24	0	0.06	0	6	0	0.13	0
OU1	VAS-34	2/20/2018	Upper Aquifer	7.1	1	0.45	0	0.24	0					0.13	0
OU1	VAS-37	9/18/2018	Upper Aquifer	2.4	1	0.8	0	19	1	1.9	1	6	0	0.18	0
OU1	VAS-38	2/7/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0	0.064	0	6	0	0.13	0
OU1	VAS-38	2/7/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0					0.13	0
OU1	VAS-38	2/7/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0					0.13	0
OU1	VAS-38	2/7/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0					0.13	0
OU1	VAS-38	2/8/2018	Upper Aquifer	0.33	0	0.45	0	0.24	0					0.13	0
OU1	VAS-38	2/8/2018	Upper Aquifer	8.3	0	230	1	6	0					0.13	0
OU1	VAS-38	2/8/2018	Upper Aquifer	13	0	270	1	9.6	0					0.13	0
OU1	VAS-38	2/9/2018	Upper Aquifer	0.33	0	20	1	0.24	0	0.061	0	6	0	0.13	0
OU1	VAS-44	1/25/2018	Upper Aquifer	0.35	1	0.45	0	0.26	1					0.56	1
OU1	VAS-44	1/26/2018	Upper Aquifer	0.33	0	0.45	0	0.49	1					0.36	1
OU1	VAS-44	1/29/2018	Upper Aquifer	0.33	0	2.5	1	0.24	0					0.13	0
OU1	VAS-44	1/29/2018	Upper Aquifer	8.3	0	250	1	6	0					0.13	0
OU1	VAS-44	1/29/2018	Upper Aquifer	0.33	0	2.9	1	0.24	0					0.13	0
OU1	VAS-44	1/30/2018	Upper Aquifer	0.33	0	6.8	1	0.24	0					0.13	0

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	155	Number of Distinct Observations	48
		Number of Missing Observations	1
Number of Detects	41	Number of Non-Detects	114
Number of Distinct Detects	34	Number of Distinct Non-Detects	17
Minimum Detect	0.18	Minimum Non-Detect	0.17
Maximum Detect	23	Maximum Non-Detect	11
Variance Detects	16.33	Percent Non-Detects	73.55%
Mean Detects	1.636	SD Detects	4.041
Median Detects	0.44	CV Detects	2.471
Skewness Detects	4.466	Kurtosis Detects	21.3
Mean of Logged Detects	-0.492	SD of Logged Detects	1.119

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.386	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.941	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.367	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.137	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.626	KM Standard Error of Mean	0.175
KM SD	2.147	95% KM (BCA) UCL	0.917
95% KM (t) UCL	0.917	95% KM (Percentile Bootstrap) UCL	0.94
95% KM (z) UCL	0.915	95% KM Bootstrap t UCL	1.538
90% KM Chebyshev UCL	1.153	95% KM Chebyshev UCL	1.391
97.5% KM Chebyshev UCL	1.722	99% KM Chebyshev UCL	2.371

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.101	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.801	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.292	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.145	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.624	k star (bias corrected MLE)	0.595
Theta hat (MLE)	2.62	Theta star (bias corrected MLE)	2.749
nu hat (MLE)	51.19	nu star (bias corrected)	48.78
Mean (detects)	1.636		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.542
Maximum	23	Median	0.01
SD	2.203	CV	4.063
k hat (MLE)	0.276	k star (bias corrected MLE)	0.275
Theta hat (MLE)	1.964	Theta star (bias corrected MLE)	1.971
nu hat (MLE)	85.6	nu star (bias corrected)	85.27
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (85.27, α)	64.99	Adjusted Chi Square Value (85.27, β)	64.82
95% Gamma Approximate UCL (use when n>=50)	0.711	95% Gamma Adjusted UCL (use when n<50)	0.713

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.626	SD (KM)	2.147
Variance (KM)	4.608	SE of Mean (KM)	0.175
k hat (KM)	0.0852	k star (KM)	0.0878
nu hat (KM)	26.4	nu star (KM)	27.22
theta hat (KM)	7.356	theta star (KM)	7.134
80% gamma percentile (KM)	0.354	90% gamma percentile (KM)	1.568
95% gamma percentile (KM)	3.65	99% gamma percentile (KM)	10.61

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (27.22, α)	16.33	Adjusted Chi Square Value (27.22, β)	16.25
95% Gamma Approximate KM-UCL (use when n>=50)	1.045	95% Gamma Adjusted KM-UCL (use when n<50)	1.05

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.828	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.941	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.202	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.137	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.575	Mean in Log Scale	-1.718
SD in Original Scale	2.164	SD in Log Scale	1.297
95% t UCL (assumes normality of ROS data)	0.862	95% Percentile Bootstrap UCL	0.887
95% BCA Bootstrap UCL	1.063	95% Bootstrap t UCL	1.546
95% H-UCL (Log ROS)	0.54		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.195	KM Geo Mean	0.303
KM SD (logged)	0.793	95% Critical H Value (KM-Log)	2.03
KM Standard Error of Mean (logged)	0.0775	95% H-UCL (KM -Log)	0.472
KM SD (logged)	0.793	95% Critical H Value (KM-Log)	2.03
KM Standard Error of Mean (logged)	0.0775		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.868	Mean in Log Scale	-0.86
SD in Original Scale	2.234	SD in Log Scale	0.99
95% t UCL (Assumes normality)	1.165	95% H-Stat UCL	0.823

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1.391

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,4-Dichlorobenzene

General Statistics

Total Number of Observations	155	Number of Distinct Observations	30
		Number of Missing Observations	1
Number of Detects	14	Number of Non-Detects	141
Number of Distinct Detects	14	Number of Distinct Non-Detects	20
Minimum Detect	0.16	Minimum Non-Detect	0.16
Maximum Detect	5.6	Maximum Non-Detect	11
Variance Detects	2.14	Percent Non-Detects	90.97%
Mean Detects	1.006	SD Detects	1.463
Median Detects	0.445	CV Detects	1.455
Skewness Detects	2.791	Kurtosis Detects	8.251
Mean of Logged Detects	-0.567	SD of Logged Detects	0.99

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.589	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.349	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.268	KM Standard Error of Mean	0.0441
KM SD	0.5	95% KM (BCA) UCL	0.343
95% KM (t) UCL	0.341	95% KM (Percentile Bootstrap) UCL	0.34
95% KM (z) UCL	0.341	95% KM Bootstrap t UCL	0.426
90% KM Chebyshev UCL	0.401	95% KM Chebyshev UCL	0.46
97.5% KM Chebyshev UCL	0.544	99% KM Chebyshev UCL	0.707

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.194	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.76	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.324	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.235	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.008	k star (bias corrected MLE)	0.839
Theta hat (MLE)	0.998	Theta star (bias corrected MLE)	1.198
nu hat (MLE)	28.21	nu star (bias corrected)	23.5
Mean (detects)	1.006		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.139
Maximum	5.6	Median	0.01
SD	0.537	CV	3.852
k hat (MLE)	0.336	k star (bias corrected MLE)	0.334
Theta hat (MLE)	0.415	Theta star (bias corrected MLE)	0.417
nu hat (MLE)	104.2	nu star (bias corrected)	103.5
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (103.51, α)	81.04	Adjusted Chi Square Value (103.51, β)	80.85
95% Gamma Approximate UCL (use when n>=50)	0.178	95% Gamma Adjusted UCL (use when n<50)	0.178

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,4-Dichlorobenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.268	SD (KM)	0.5
Variance (KM)	0.25	SE of Mean (KM)	0.0441
k hat (KM)	0.288	k star (KM)	0.286
nu hat (KM)	89.19	nu star (KM)	88.79
theta hat (KM)	0.933	theta star (KM)	0.937
80% gamma percentile (KM)	0.407	90% gamma percentile (KM)	0.796
95% gamma percentile (KM)	1.246	99% gamma percentile (KM)	2.422

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (88.79, α)	68.07	Adjusted Chi Square Value (88.79, β)	67.9
95% Gamma Approximate KM-UCL (use when n>=50)	0.35	95% Gamma Adjusted KM-UCL (use when n<50)	0.351

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.899	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.265	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.18	Mean in Log Scale	-2.739
SD in Original Scale	0.514	SD in Log Scale	1.342
95% t UCL (assumes normality of ROS data)	0.248	95% Percentile Bootstrap UCL	0.255
95% BCA Bootstrap UCL	0.288	95% Bootstrap t UCL	0.34
95% H-UCL (Log ROS)	0.209		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.601	KM Geo Mean	0.202
KM SD (logged)	0.524	95% Critical H Value (KM-Log)	1.846
KM Standard Error of Mean (logged)	0.0626	95% H-UCL (KM -Log)	0.25
KM SD (logged)	0.524	95% Critical H Value (KM-Log)	1.846
KM Standard Error of Mean (logged)	0.0626		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.63	Mean in Log Scale	-0.96
SD in Original Scale	0.928	SD in Log Scale	0.933
95% t UCL (Assumes normality)	0.754	95% H-Stat UCL	0.696

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.25

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene

General Statistics

Total Number of Observations	155	Number of Distinct Observations	47
		Number of Missing Observations	1
Number of Detects	39	Number of Non-Detects	116
Number of Distinct Detects	35	Number of Distinct Non-Detects	15
Minimum Detect	0.15	Minimum Non-Detect	0.13
Maximum Detect	100	Maximum Non-Detect	11
Variance Detects	405	Percent Non-Detects	74.84%
Mean Detects	5.523	SD Detects	20.13
Median Detects	0.49	CV Detects	3.644
Skewness Detects	4.261	Kurtosis Detects	17.5
Mean of Logged Detects	-0.403	SD of Logged Detects	1.439

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.288	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.939	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.459	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.14	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.587	KM Standard Error of Mean	0.832
KM SD	10.22	95% KM (BCA) UCL	3.301
95% KM (t) UCL	2.964	95% KM (Percentile Bootstrap) UCL	3.08
95% KM (z) UCL	2.956	95% KM Bootstrap t UCL	16.3
90% KM Chebyshev UCL	4.084	95% KM Chebyshev UCL	5.215
97.5% KM Chebyshev UCL	6.784	99% KM Chebyshev UCL	9.868

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	8.518	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.852	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.418	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.153	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.323	k star (bias corrected MLE)	0.315
Theta hat (MLE)	17.12	Theta star (bias corrected MLE)	17.54
nu hat (MLE)	25.17	nu star (bias corrected)	24.56
Mean (detects)	5.523		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.91
Maximum	100	Median	0.01
SD	10.46	CV	5.476
k hat (MLE)	0.198	k star (bias corrected MLE)	0.198
Theta hat (MLE)	9.656	Theta star (bias corrected MLE)	9.633
nu hat (MLE)	61.33	nu star (bias corrected)	61.48
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (61.48, α)	44.44	Adjusted Chi Square Value (61.48, β)	44.31
95% Gamma Approximate UCL (use when n>=50)	2.642	95% Gamma Adjusted UCL (use when n<50)	2.651

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.587	SD (KM)	10.22
Variance (KM)	104.5	SE of Mean (KM)	0.832
k hat (KM)	0.0241	k star (KM)	0.0279
nu hat (KM)	7.47	nu star (KM)	8.658
theta hat (KM)	65.87	theta star (KM)	56.82
80% gamma percentile (KM)	0.0111	90% gamma percentile (KM)	0.76
95% gamma percentile (KM)	5.724	99% gamma percentile (KM)	41.73

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.66, α)	3.122	Adjusted Chi Square Value (8.66, β)	3.091
95% Gamma Approximate KM-UCL (use when n>=50)	4.402	95% Gamma Adjusted KM-UCL (use when n<50)	4.446

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.727	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.939	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.242	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.14	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.57	Mean in Log Scale	-1.76
SD in Original Scale	10.26	SD in Log Scale	1.546
95% t UCL (assumes normality of ROS data)	2.934	95% Percentile Bootstrap UCL	3.014
95% BCA Bootstrap UCL	3.878	95% Bootstrap t UCL	14.21
95% H-UCL (Log ROS)	0.802		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.233	KM Geo Mean	0.291
KM SD (logged)	0.982	95% Critical H Value (KM-Log)	2.192
KM Standard Error of Mean (logged)	0.102	95% H-UCL (KM -Log)	0.561
KM SD (logged)	0.982	95% Critical H Value (KM-Log)	2.192
KM Standard Error of Mean (logged)	0.102		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.829	Mean in Log Scale	-0.836
SD in Original Scale	10.25	SD in Log Scale	1.071
95% t UCL (Assumes normality)	3.192	95% H-Stat UCL	0.936

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	5.215

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane)

General Statistics

Total Number of Observations	155	Number of Distinct Observations	28
		Number of Missing Observations	1
Number of Detects	8	Number of Non-Detects	147
Number of Distinct Detects	8	Number of Distinct Non-Detects	20
Minimum Detect	0.32	Minimum Non-Detect	0.13
Maximum Detect	1.3	Maximum Non-Detect	12
Variance Detects	0.0907	Percent Non-Detects	94.84%
Mean Detects	0.619	SD Detects	0.301
Median Detects	0.58	CV Detects	0.487
Skewness Detects	1.919	Kurtosis Detects	4.535
Mean of Logged Detects	-0.564	SD of Logged Detects	0.42

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.801	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.275	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.194	KM Standard Error of Mean	0.0236
KM SD	0.172	95% KM (BCA) UCL	0.233
95% KM (t) UCL	0.233	95% KM (Percentile Bootstrap) UCL	0.233
95% KM (z) UCL	0.233	95% KM Bootstrap t UCL	0.235
90% KM Chebyshev UCL	0.265	95% KM Chebyshev UCL	0.297
97.5% KM Chebyshev UCL	0.342	99% KM Chebyshev UCL	0.429

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.429	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.718	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.226	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.295	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	6.137	k star (bias corrected MLE)	3.919
Theta hat (MLE)	0.101	Theta star (bias corrected MLE)	0.158
nu hat (MLE)	98.19	nu star (bias corrected)	62.7
Mean (detects)	0.619		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.108
Maximum	1.3	Median	0.01
SD	0.201	CV	1.863
k hat (MLE)	0.475	k star (bias corrected MLE)	0.47
Theta hat (MLE)	0.228	Theta star (bias corrected MLE)	0.23
nu hat (MLE)	147.2	nu star (bias corrected)	145.7
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (145.71, α)	118.8	Adjusted Chi Square Value (145.71, β)	118.6
95% Gamma Approximate UCL (use when n>=50)	0.133	95% Gamma Adjusted UCL (use when n<50)	0.133

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.194	SD (KM)	0.172
Variance (KM)	0.0297	SE of Mean (KM)	0.0236
k hat (KM)	1.274	k star (KM)	1.254
nu hat (KM)	394.9	nu star (KM)	388.6
theta hat (KM)	0.153	theta star (KM)	0.155
80% gamma percentile (KM)	0.306	90% gamma percentile (KM)	0.423
95% gamma percentile (KM)	0.538	99% gamma percentile (KM)	0.801

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (388.59, α)	343.9	Adjusted Chi Square Value (388.59, β)	343.5
95% Gamma Approximate KM-UCL (use when n>=50)	0.22	95% Gamma Adjusted KM-UCL (use when n<50)	0.22

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.21	Mean in Log Scale	-1.794
SD in Original Scale	0.168	SD in Log Scale	0.677
95% t UCL (assumes normality of ROS data)	0.233	95% Percentile Bootstrap UCL	0.232
95% BCA Bootstrap UCL	0.237	95% Bootstrap t UCL	0.237
95% H-UCL (Log ROS)	0.233		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.829	KM Geo Mean	0.161
KM SD (logged)	0.516	95% Critical H Value (KM-Log)	1.842
KM Standard Error of Mean (logged)	0.0757	95% H-UCL (KM -Log)	0.198
KM SD (logged)	0.516	95% Critical H Value (KM-Log)	1.842
KM Standard Error of Mean (logged)	0.0757		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.624	Mean in Log Scale	-0.892
SD in Original Scale	0.902	SD in Log Scale	0.835
95% t UCL (Assumes normality)	0.744	95% H-Stat UCL	0.667

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.233

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene

General Statistics

Total Number of Observations	155	Number of Distinct Observations	33
		Number of Missing Observations	1
Number of Detects	18	Number of Non-Detects	137
Number of Distinct Detects	17	Number of Distinct Non-Detects	18
Minimum Detect	0.27	Minimum Non-Detect	0.11
Maximum Detect	100	Maximum Non-Detect	10
Variance Detects	545.1	Percent Non-Detects	88.39%
Mean Detects	6.919	SD Detects	23.35
Median Detects	0.63	CV Detects	3.374
Skewness Detects	4.174	Kurtosis Detects	17.57
Mean of Logged Detects	0.0039	SD of Logged Detects	1.487

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.309	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.43	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.96	KM Standard Error of Mean	0.664
KM SD	8.03	95% KM (BCA) UCL	2.294
95% KM (t) UCL	2.059	95% KM (Percentile Bootstrap) UCL	2.238
95% KM (z) UCL	2.052	95% KM Bootstrap t UCL	13.56
90% KM Chebyshev UCL	2.952	95% KM Chebyshev UCL	3.854
97.5% KM Chebyshev UCL	5.107	99% KM Chebyshev UCL	7.567

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.481	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.832	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.362	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.219	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.349	k star (bias corrected MLE)	0.328
Theta hat (MLE)	19.85	Theta star (bias corrected MLE)	21.13
nu hat (MLE)	12.55	nu star (bias corrected)	11.79
Mean (detects)	6.919		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.997
Maximum	100	Median	0.01
SD	8.137	CV	8.158
k hat (MLE)	0.191	k star (bias corrected MLE)	0.192
Theta hat (MLE)	5.209	Theta star (bias corrected MLE)	5.193
nu hat (MLE)	59.36	nu star (bias corrected)	59.54
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (59.54, α)	42.8	Adjusted Chi Square Value (59.54, β)	42.67
95% Gamma Approximate UCL (use when n>=50)	1.388	95% Gamma Adjusted UCL (use when n<50)	1.392

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.96	SD (KM)	8.03
Variance (KM)	64.49	SE of Mean (KM)	0.664
k hat (KM)	0.0143	k star (KM)	0.0183
nu hat (KM)	4.429	nu star (KM)	5.677
theta hat (KM)	67.18	theta star (KM)	52.42
80% gamma percentile (KM)	1.5250E-4	90% gamma percentile (KM)	0.0949
95% gamma percentile (KM)	1.879	99% gamma percentile (KM)	27.05

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.68, α)	1.477	Adjusted Chi Square Value (5.68, β)	1.457
95% Gamma Approximate KM-UCL (use when n>=50)	3.689	95% Gamma Adjusted KM-UCL (use when n<50)	3.739

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.749	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.897	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.202	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.899	Mean in Log Scale	-3.238
SD in Original Scale	8.064	SD in Log Scale	2.122
95% t UCL (assumes normality of ROS data)	1.971	95% Percentile Bootstrap UCL	2.168
95% BCA Bootstrap UCL	2.975	95% Bootstrap t UCL	14.85
95% H-UCL (Log ROS)	0.673		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.741	KM Geo Mean	0.175
KM SD (logged)	0.962	95% Critical H Value (KM-Log)	2.174
KM Standard Error of Mean (logged)	0.104	95% H-UCL (KM -Log)	0.33
KM SD (logged)	0.962	95% Critical H Value (KM-Log)	2.174
KM Standard Error of Mean (logged)	0.104		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.287	Mean in Log Scale	-0.902
SD in Original Scale	8.051	SD in Log Scale	1.019
95% t UCL (Assumes normality)	2.357	95% H-Stat UCL	0.819

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	3.854

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	155	Number of Distinct Observations	63
		Number of Missing Observations	1
Number of Detects	68	Number of Non-Detects	87
Number of Distinct Detects	53	Number of Distinct Non-Detects	14
Minimum Detect	0.17	Minimum Non-Detect	0.1
Maximum Detect	94	Maximum Non-Detect	13
Variance Detects	558.8	Percent Non-Detects	56.13%
Mean Detects	12	SD Detects	23.64
Median Detects	1.8	CV Detects	1.97
Skewness Detects	2.291	Kurtosis Detects	4.085
Mean of Logged Detects	0.901	SD of Logged Detects	1.72

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.544	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.348	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.107	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	5.441	KM Standard Error of Mean	1.343
KM SD	16.59	95% KM (BCA) UCL	7.884
95% KM (t) UCL	7.663	95% KM (Percentile Bootstrap) UCL	7.774
95% KM (z) UCL	7.65	95% KM Bootstrap t UCL	8.355
90% KM Chebyshev UCL	9.47	95% KM Chebyshev UCL	11.29
97.5% KM Chebyshev UCL	13.83	99% KM Chebyshev UCL	18.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.768	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.838	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.248	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.116	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.413	k star (bias corrected MLE)	0.405
Theta hat (MLE)	29.03	Theta star (bias corrected MLE)	29.63
nu hat (MLE)	56.22	nu star (bias corrected)	55.07
Mean (detects)	12		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	5.27
Maximum	94	Median	0.01
SD	16.7	CV	3.168
k hat (MLE)	0.192	k star (bias corrected MLE)	0.193
Theta hat (MLE)	27.41	Theta star (bias corrected MLE)	27.33
nu hat (MLE)	59.6	nu star (bias corrected)	59.78
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (59.78, α)	43	Adjusted Chi Square Value (59.78, β)	42.87
95% Gamma Approximate UCL (use when n>=50)	7.326	95% Gamma Adjusted UCL (use when n<50)	7.349

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	5.441	SD (KM)	16.59
Variance (KM)	275.3	SE of Mean (KM)	1.343
k hat (KM)	0.108	k star (KM)	0.11
nu hat (KM)	33.34	nu star (KM)	34.03
theta hat (KM)	50.59	theta star (KM)	49.57
80% gamma percentile (KM)	4.287	90% gamma percentile (KM)	15
95% gamma percentile (KM)	31.36	99% gamma percentile (KM)	82.46

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (34.03, α)	21.69	Adjusted Chi Square Value (34.03, β)	21.59
95% Gamma Approximate KM-UCL (use when n>=50)	8.537	95% Gamma Adjusted KM-UCL (use when n<50)	8.574

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.903	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	1.2965E-5	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.14	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.107	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	5.378	Mean in Log Scale	-1
SD in Original Scale	16.66	SD in Log Scale	2.335
95% t UCL (assumes normality of ROS data)	7.593	95% Percentile Bootstrap UCL	7.621
95% BCA Bootstrap UCL	7.994	95% Bootstrap t UCL	8.211
95% H-UCL (Log ROS)	11.3		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.478	KM Geo Mean	0.62
KM SD (logged)	1.766	95% Critical H Value (KM-Log)	3.021
KM Standard Error of Mean (logged)	0.163	95% H-UCL (KM -Log)	4.53
KM SD (logged)	1.766	95% Critical H Value (KM-Log)	3.021
KM Standard Error of Mean (logged)	0.163		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	5.675	Mean in Log Scale	-0.118
SD in Original Scale	16.59	SD in Log Scale	1.626
95% t UCL (Assumes normality)	7.88	95% H-Stat UCL	4.848

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	11.29

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride

General Statistics

Total Number of Observations	155	Number of Distinct Observations	49
		Number of Missing Observations	1
Number of Detects	54	Number of Non-Detects	101
Number of Distinct Detects	43	Number of Distinct Non-Detects	12
Minimum Detect	0.25	Minimum Non-Detect	0.2
Maximum Detect	620	Maximum Non-Detect	11
Variance Detects	12495	Percent Non-Detects	65.16%
Mean Detects	38.66	SD Detects	111.8
Median Detects	2.7	CV Detects	2.892
Skewness Detects	3.794	Kurtosis Detects	15.44
Mean of Logged Detects	1.296	SD of Logged Detects	1.999

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.4	**Normal GOF Test on Detected Observations Only**
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.437	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.12	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	13.67	KM Standard Error of Mean	5.503
KM SD	67.87	95% KM (BCA) UCL	23.7
95% KM (t) UCL	22.78	95% KM (Percentile Bootstrap) UCL	23.18
95% KM (z) UCL	22.72	95% KM Bootstrap t UCL	30.45
90% KM Chebyshev UCL	30.18	95% KM Chebyshev UCL	37.66
97.5% KM Chebyshev UCL	48.04	99% KM Chebyshev UCL	68.42

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	5.956	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.866	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.288	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.132	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.293	k star (bias corrected MLE)	0.289
Theta hat (MLE)	131.8	Theta star (bias corrected MLE)	133.6
nu hat (MLE)	31.69	nu star (bias corrected)	31.26
Mean (detects)	38.66		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	13.47
Maximum	620	Median	0.01
SD	68.13	CV	5.057
k hat (MLE)	0.149	k star (bias corrected MLE)	0.151
Theta hat (MLE)	90.22	Theta star (bias corrected MLE)	89.38
nu hat (MLE)	46.29	nu star (bias corrected)	46.73
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (46.73, α)	32.04	Adjusted Chi Square Value (46.73, β)	31.93
95% Gamma Approximate UCL (use when n>=50)	19.65	95% Gamma Adjusted UCL (use when n<50)	19.72

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	13.67	SD (KM)	67.87
Variance (KM)	4606	SE of Mean (KM)	5.503
k hat (KM)	0.0406	k star (KM)	0.0441
nu hat (KM)	12.58	nu star (KM)	13.67
theta hat (KM)	336.9	theta star (KM)	310
80% gamma percentile (KM)	1.148	90% gamma percentile (KM)	17.44
95% gamma percentile (KM)	69.02	99% gamma percentile (KM)	312

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.67, α)	6.346	Adjusted Chi Square Value (13.67, β)	6.299
95% Gamma Approximate KM-UCL (use when n>=50)	29.45	95% Gamma Adjusted KM-UCL (use when n<50)	29.67

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Approximate Test Statistic	0.909	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk P Value	3.6908E-4	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.106	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.12	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	13.62	Mean in Log Scale	-1.233
SD in Original Scale	68.1	SD in Log Scale	2.628
95% t UCL (assumes normality of ROS data)	22.67	95% Percentile Bootstrap UCL	23.48
95% BCA Bootstrap UCL	26.62	95% Bootstrap t UCL	28.89
95% H-UCL (Log ROS)	21.94		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.356	KM Geo Mean	0.701
KM SD (logged)	1.706	95% Critical H Value (KM-Log)	2.951
KM Standard Error of Mean (logged)	0.147	95% H-UCL (KM -Log)	4.501
KM SD (logged)	1.706	95% Critical H Value (KM-Log)	2.951
KM Standard Error of Mean (logged)	0.147		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	13.79	Mean in Log Scale	-0.149
SD in Original Scale	68.07	SD in Log Scale	1.652
95% t UCL (Assumes normality)	22.84	95% H-Stat UCL	4.956

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	4.501

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total)

General Statistics

Total Number of Observations	155	Number of Distinct Observations	37
		Number of Missing Observations	1
Number of Detects	21	Number of Non-Detects	134
Number of Distinct Detects	21	Number of Distinct Non-Detects	18
Minimum Detect	0.26	Minimum Non-Detect	0.15
Maximum Detect	190	Maximum Non-Detect	10
Variance Detects	1702	Percent Non-Detects	86.45%
Mean Detects	13.65	SD Detects	41.25
Median Detects	1.4	CV Detects	3.022
Skewness Detects	4.303	Kurtosis Detects	19.06
Mean of Logged Detects	0.769	SD of Logged Detects	1.743

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.345	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.418	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.047	KM Standard Error of Mean	1.277
KM SD	15.52	95% KM (BCA) UCL	4.53
95% KM (t) UCL	4.161	95% KM (Percentile Bootstrap) UCL	4.474
95% KM (z) UCL	4.148	95% KM Bootstrap t UCL	16.8
90% KM Chebyshev UCL	5.879	95% KM Chebyshev UCL	7.615
97.5% KM Chebyshev UCL	10.02	99% KM Chebyshev UCL	14.76

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.039	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.833	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.267	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.204	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.362	k star (bias corrected MLE)	0.342
Theta hat (MLE)	37.67	Theta star (bias corrected MLE)	39.87
nu hat (MLE)	15.22	nu star (bias corrected)	14.38
Mean (detects)	13.65		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.934
Maximum	190	Median	0.01
SD	15.59	CV	8.064
k hat (MLE)	0.17	k star (bias corrected MLE)	0.171
Theta hat (MLE)	11.35	Theta star (bias corrected MLE)	11.29
nu hat (MLE)	52.8	nu star (bias corrected)	53.11
Adjusted Level of Significance (β)	0.0485		
Approximate Chi Square Value (53.11, α)	37.37	Adjusted Chi Square Value (53.11, β)	37.25
95% Gamma Approximate UCL (use when n>=50)	2.748	95% Gamma Adjusted UCL (use when n<50)	2.757

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Xylenes (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.047	SD (KM)	15.52
Variance (KM)	240.8	SE of Mean (KM)	1.277
k hat (KM)	0.0174	k star (KM)	0.0214
nu hat (KM)	5.393	nu star (KM)	6.621
theta hat (KM)	117.7	theta star (KM)	95.81
80% gamma percentile (KM)	0.00159	90% gamma percentile (KM)	0.396
95% gamma percentile (KM)	5.227	99% gamma percentile (KM)	56.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.62, α)	1.965	Adjusted Chi Square Value (6.62, β)	1.942
95% Gamma Approximate KM-UCL (use when n>=50)	6.895	95% Gamma Adjusted KM-UCL (use when n<50)	6.979

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.937	Mean in Log Scale	-3.684
SD in Original Scale	15.58	SD in Log Scale	2.864
95% t UCL (assumes normality of ROS data)	4.007	95% Percentile Bootstrap UCL	4.459
95% BCA Bootstrap UCL	6.436	95% Bootstrap t UCL	16.41
95% H-UCL (Log ROS)	4.189		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.369	KM Geo Mean	0.254
KM SD (logged)	1.157	95% Critical H Value (KM-Log)	2.356
KM Standard Error of Mean (logged)	0.113	95% H-UCL (KM -Log)	0.619
KM SD (logged)	1.157	95% Critical H Value (KM-Log)	2.356
KM Standard Error of Mean (logged)	0.113		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.631	Mean in Log Scale	-0.399
SD in Original Scale	15.52	SD in Log Scale	1.296
95% t UCL (Assumes normality)	4.693	95% H-Stat UCL	2.016

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	0.619

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	115	Number of Distinct Observations	23
		Number of Missing Observations	35
Number of Detects	10	Number of Non-Detects	105
Number of Distinct Detects	10	Number of Distinct Non-Detects	14
Minimum Detect	0.32	Minimum Non-Detect	0.06
Maximum Detect	9.8	Maximum Non-Detect	11
Variance Detects	9.33	Percent Non-Detects	91.3%
Mean Detects	2.668	SD Detects	3.055
Median Detects	1.35	CV Detects	1.145
Skewness Detects	1.672	Kurtosis Detects	2.539
Mean of Logged Detects	0.383	SD of Logged Detects	1.192

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.773	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.299	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.315	KM Standard Error of Mean	0.113
KM SD	1.131	95% KM (BCA) UCL	0.501
95% KM (t) UCL	0.502	95% KM (Percentile Bootstrap) UCL	0.51
95% KM (z) UCL	0.501	95% KM Bootstrap t UCL	0.713
90% KM Chebyshev UCL	0.654	95% KM Chebyshev UCL	0.807
97.5% KM Chebyshev UCL	1.02	99% KM Chebyshev UCL	1.439

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.434	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.274	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.969	k star (bias corrected MLE)	0.745
Theta hat (MLE)	2.754	Theta star (bias corrected MLE)	3.583
nu hat (MLE)	19.37	nu star (bias corrected)	14.89
Mean (detects)	2.668		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.25
Maximum	9.8	Median	0.01
SD	1.142	CV	4.565
k hat (MLE)	0.26	k star (bias corrected MLE)	0.259
Theta hat (MLE)	0.963	Theta star (bias corrected MLE)	0.967
nu hat (MLE)	59.73	nu star (bias corrected)	59.5
Adjusted Level of Significance (β)	0.0479		
Approximate Chi Square Value (59.50, α)	42.77	Adjusted Chi Square Value (59.50, β)	42.59
95% Gamma Approximate UCL (use when n>=50)	0.348	95% Gamma Adjusted UCL (use when n<50)	0.349

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.315	SD (KM)	1.131
Variance (KM)	1.279	SE of Mean (KM)	0.113
k hat (KM)	0.0775	k star (KM)	0.0813
nu hat (KM)	17.83	nu star (KM)	18.7
theta hat (KM)	4.062	theta star (KM)	3.874
80% gamma percentile (KM)	0.155	90% gamma percentile (KM)	0.754
95% gamma percentile (KM)	1.833	99% gamma percentile (KM)	5.535

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (18.70, α)	9.898	Adjusted Chi Square Value (18.70, β)	9.816
95% Gamma Approximate KM-UCL (use when n>=50)	0.595	95% Gamma Adjusted KM-UCL (use when n<50)	0.6

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.928	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.148	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.281	Mean in Log Scale	-4.074
SD in Original Scale	1.138	SD in Log Scale	2.371
95% t UCL (assumes normality of ROS data)	0.457	95% Percentile Bootstrap UCL	0.483
95% BCA Bootstrap UCL	0.563	95% Bootstrap t UCL	0.645
95% H-UCL (Log ROS)	0.657		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.388	KM Geo Mean	0.0918
KM SD (logged)	1.047	95% Critical H Value (KM-Log)	2.262
KM Standard Error of Mean (logged)	0.139	95% H-UCL (KM -Log)	0.198
KM SD (logged)	1.047	95% Critical H Value (KM-Log)	2.262
KM Standard Error of Mean (logged)	0.139		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.667	Mean in Log Scale	-1.087
SD in Original Scale	1.185	SD in Log Scale	1.27
95% t UCL (Assumes normality)	0.85	95% H-Stat UCL	1.015

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Approximate Gamma UCL	0.595

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total)

General Statistics

Total Number of Observations	26	Number of Distinct Observations	11
		Number of Missing Observations	124
Number of Detects	7	Number of Non-Detects	19
Number of Distinct Detects	7	Number of Distinct Non-Detects	4
Minimum Detect	7.4	Minimum Non-Detect	5
Maximum Detect	580	Maximum Non-Detect	12
Variance Detects	49394	Percent Non-Detects	73.08%
Mean Detects	178.5	SD Detects	222.2
Median Detects	86	CV Detects	1.245
Skewness Detects	1.276	Kurtosis Detects	0.394
Mean of Logged Detects	4.169	SD of Logged Detects	1.766

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.81	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.265	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	51.72	KM Standard Error of Mean	27.88
KM SD	131.6	95% KM (BCA) UCL	101.3
95% KM (t) UCL	99.34	95% KM (Percentile Bootstrap) UCL	94.97
95% KM (z) UCL	97.57	95% KM Bootstrap t UCL	197.7
90% KM Chebyshev UCL	135.3	95% KM Chebyshev UCL	173.2
97.5% KM Chebyshev UCL	225.8	99% KM Chebyshev UCL	329.1

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.292	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.745	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.17	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.325	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.607	k star (bias corrected MLE)	0.442
Theta hat (MLE)	293.8	Theta star (bias corrected MLE)	403.5
nu hat (MLE)	8.503	nu star (bias corrected)	6.192
Mean (detects)	178.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	48.05
Maximum	580	Median	0.01
SD	135.5	CV	2.821
k hat (MLE)	0.128	k star (bias corrected MLE)	0.139
Theta hat (MLE)	374	Theta star (bias corrected MLE)	345
nu hat (MLE)	6.681	nu star (bias corrected)	7.243
Adjusted Level of Significance (β)	0.0398		
Approximate Chi Square Value (7.24, α)	2.305	Adjusted Chi Square Value (7.24, β)	2.125
95% Gamma Approximate UCL (use when n>=50)	151	95% Gamma Adjusted UCL (use when n<50)	163.8

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cyanide (total) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	51.72	SD (KM)	131.6
Variance (KM)	17316	SE of Mean (KM)	27.88
k hat (KM)	0.154	k star (KM)	0.162
nu hat (KM)	8.033	nu star (KM)	8.44
theta hat (KM)	334.8	theta star (KM)	318.7
80% gamma percentile (KM)	59.84	90% gamma percentile (KM)	154.8
95% gamma percentile (KM)	280.1	99% gamma percentile (KM)	638.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (8.44, α)	2.992	Adjusted Chi Square Value (8.44, β)	2.781
95% Gamma Approximate KM-UCL (use when n>=50)	145.9	95% Gamma Adjusted KM-UCL (use when n<50)	156.9

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	48.4	Mean in Log Scale	-0.604
SD in Original Scale	135.4	SD in Log Scale	3.661
95% t UCL (assumes normality of ROS data)	93.76	95% Percentile Bootstrap UCL	94.55
95% BCA Bootstrap UCL	112.4	95% Bootstrap t UCL	228.3
95% H-UCL (Log ROS)	67065		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.302	KM Geo Mean	9.993
KM SD (logged)	1.416	95% Critical H Value (KM-Log)	3.089
KM Standard Error of Mean (logged)	0.3	95% H-UCL (KM -Log)	65.31
KM SD (logged)	1.416	95% Critical H Value (KM-Log)	3.089
KM Standard Error of Mean (logged)	0.3		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	50.37	Mean in Log Scale	1.95
SD in Original Scale	134.7	SD in Log Scale	1.633
95% t UCL (Assumes normality)	95.49	95% H-Stat UCL	81.53

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	99.34

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	75	Number of Distinct Observations	8
		Number of Missing Observations	81
Number of Detects	4	Number of Non-Detects	71
Number of Distinct Detects	4	Number of Distinct Non-Detects	4
Minimum Detect	0.24	Minimum Non-Detect	0.13
Maximum Detect	0.56	Maximum Non-Detect	0.32
Variance Detects	0.0193	Percent Non-Detects	94.67%
Mean Detects	0.365	SD Detects	0.139
Median Detects	0.33	CV Detects	0.381
Skewness Detects	1.29	Kurtosis Detects	1.784
Mean of Logged Detects	-1.058	SD of Logged Detects	0.359

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.143	KM Standard Error of Mean	0.00797
KM SD	0.0597	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.156	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.156	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.166	95% KM Chebyshev UCL	0.177
97.5% KM Chebyshev UCL	0.192	99% KM Chebyshev UCL	0.222

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.275	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.657	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.226	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.395	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.11	k star (bias corrected MLE)	2.694
Theta hat (MLE)	0.0361	Theta star (bias corrected MLE)	0.136
nu hat (MLE)	80.86	nu star (bias corrected)	21.55
Mean (detects)	0.365		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.033
Maximum	0.56	Median	0.01
SD	0.0862	CV	2.614
k hat (MLE)	0.681	k star (bias corrected MLE)	0.663
Theta hat (MLE)	0.0484	Theta star (bias corrected MLE)	0.0498
nu hat (MLE)	102.1	nu star (bias corrected)	99.38
Adjusted Level of Significance (β)	0.0468		
Approximate Chi Square Value (99.38, α)	77.38	Adjusted Chi Square Value (99.38, β)	77
95% Gamma Approximate UCL (use when n>=50)	0.0423	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.21.2

Summary of ProUCL Output for OU1 Groundwater Volatilizing to Indoor Air (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.19/24/2019 3:28:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.143	SD (KM)	0.0597
Variance (KM)	0.00357	SE of Mean (KM)	0.00797
k hat (KM)	5.7	k star (KM)	5.481
nu hat (KM)	855.1	nu star (KM)	822.2
theta hat (KM)	0.025	theta star (KM)	0.026
80% gamma percentile (KM)	0.19	90% gamma percentile (KM)	0.224
95% gamma percentile (KM)	0.255	99% gamma percentile (KM)	0.321

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (822.18, α)	756.6	Adjusted Chi Square Value (822.18, β)	755.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.155	95% Gamma Adjusted KM-UCL (use when n<50)	0.155

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.969	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.21	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.063	Mean in Log Scale	-3.357
SD in Original Scale	0.0873	SD in Log Scale	1.084
95% t UCL (assumes normality of ROS data)	0.0798	95% Percentile Bootstrap UCL	0.0798
95% BCA Bootstrap UCL	0.0856	95% Bootstrap t UCL	0.0902
95% H-UCL (Log ROS)	0.0843		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.988	KM Geo Mean	0.137
KM SD (logged)	0.232	95% Critical H Value (KM-Log)	1.719
KM Standard Error of Mean (logged)	0.031	95% H-UCL (KM -Log)	0.147
KM SD (logged)	0.232	95% Critical H Value (KM-Log)	1.719
KM Standard Error of Mean (logged)	0.031		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0915	Mean in Log Scale	-2.519
SD in Original Scale	0.0734	SD in Log Scale	0.413
95% t UCL (Assumes normality)	0.106	95% H-Stat UCL	0.0957

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.156

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.1

Summary of ProUCL Input Data for EU1 EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7
OU Designation:	**Sample Location:**	**Sample Date:**	**Aquifer:**	1,1-Dichloroethane	D_1,1-Dichloroethane	Benzene	D_Benzene	Bromodichloromethane	D_Bromodichloromethane	Chlorobenzene	D_Chlorobenzene
OU1	BH92-13	7/9/2013	Upper Aquifer	5.2	1	0.55	1	1	0	5.7	1
OU1	BH93-13	7/9/2013	Upper Aquifer	1	0	0.62	1	1	0	1	0
OU1	MW-101A	5/13/2015	Upper Aquifer	0.44	1	1	0	1	0	1	0
OU1	MW-204	5/11/2015	Upper Aquifer	1	0	1	0	1	0	0.31	1
OU1	MW-209	5/12/2015	Upper Aquifer	1	0	1	0	1	0	1	0
OU1	MW-209	10/17/2018	Upper Aquifer	0.17	0	0.13	0	0.17	0	0.14	0
OU1	VAS-37	9/18/2018	Upper Aquifer	1.5	1	1.1	1	0.68	0	10	1
OU1	VAS-38	2/7/2018	Upper Aquifer	0.25	0	0.28	0	0.3	0	0.32	0
OU1	VAS-38	2/7/2018	Upper Aquifer	0.48	1	0.28	0	0.36	1	0.32	0
OU1	VAS-38	2/7/2018	Upper Aquifer	2	1	0.28	0	0.3	0	0.32	0
OU1	VAS-11	12/8/2008	Upper Aquifer	5	0	2.4	1	5	0	130	1
OU1	VAS-19	12/15/2008	Upper Aquifer	0.43	1	1	0	1	0	1	0

Table B.22.1

Summary of ProUCL Input Data for EU1 EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

			8	9	10	11	12	13	14	15
Sample Location:	**Sample Date:**	**Aquifer:**	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	Ethylbenzene	D_Ethylbenzene	Trichloroethene	D_Trichloroethene	Vinyl chloride	D_Vinyl chloride
BH92-13	7/9/2013	Upper Aquifer	1	0	0.39	1	1	0	1	0
BH93-13	7/9/2013	Upper Aquifer	1	0	1	0	1	0	1	0
MW-101A	5/13/2015	Upper Aquifer	1	0	1	0	1	0	1.7	1
MW-204	5/11/2015	Upper Aquifer	1	0	1	0	1	0	1	0
MW-209	5/12/2015	Upper Aquifer	1	0	1	0	1	0	1	1
MW-209	10/17/2018	Upper Aquifer	0.13	0	0.11	0	0.1	0	0.2	0
VAS-37	9/18/2018	Upper Aquifer	0.52	0	4.5	1	2.4	1	0.8	0
VAS-38	2/7/2018	Upper Aquifer	0.31	0	0.26	0	0.33	0	0.45	0
VAS-38	2/7/2018	Upper Aquifer	0.32	1	0.26	0	0.33	0	0.45	0
VAS-38	2/7/2018	Upper Aquifer	0.31	0	0.26	0	0.33	0	0.45	0
VAS-11	12/8/2008	Upper Aquifer	5	0	5	0	5	0	5	0
VAS-19	12/15/2008	Upper Aquifer	1	0	1	0	1	0	0.27	1

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane

General Statistics

Total Number of Observations	12	Number of Distinct Observations	10
Number of Detects	6	Number of Non-Detects	6
Number of Distinct Detects	6	Number of Distinct Non-Detects	4
Minimum Detect	0.43	Minimum Non-Detect	0.17
Maximum Detect	5.2	Maximum Non-Detect	5
Variance Detects	3.413	Percent Non-Detects	50%
Mean Detects	1.675	SD Detects	1.847
Median Detects	0.99	CV Detects	1.103
Skewness Detects	1.823	Kurtosis Detects	3.435
Mean of Logged Detects	0.0581	SD of Logged Detects	1.026

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.757	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.002	KM Standard Error of Mean	0.443
KM SD	1.386	95% KM (BCA) UCL	1.84
95% KM (t) UCL	1.797	95% KM (Percentile Bootstrap) UCL	1.759
95% KM (z) UCL	1.73	95% KM Bootstrap t UCL	2.776
90% KM Chebyshev UCL	2.331	95% KM Chebyshev UCL	2.932
97.5% KM Chebyshev UCL	3.768	99% KM Chebyshev UCL	5.408

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.517	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.712	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.296	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.339	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.232	k star (bias corrected MLE)	0.727
Theta hat (MLE)	1.359	Theta star (bias corrected MLE)	2.303
nu hat (MLE)	14.79	nu star (bias corrected)	8.727
Mean (detects)	1.675		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.883
Maximum	5.2	Median	0.43
SD	1.5	CV	1.699
k hat (MLE)	0.395	k star (bias corrected MLE)	0.352
Theta hat (MLE)	2.236	Theta star (bias corrected MLE)	2.51
nu hat (MLE)	9.474	nu star (bias corrected)	8.439
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (8.44, α)	2.992	Adjusted Chi Square Value (8.44, β)	2.519
95% Gamma Approximate UCL (use when n>=50)	2.49	95% Gamma Adjusted UCL (use when n<50)	2.957

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,1-Dichloroethane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.002	SD (KM)	1.386
Variance (KM)	1.92	SE of Mean (KM)	0.443
k hat (KM)	0.523	k star (KM)	0.448
nu hat (KM)	12.55	nu star (KM)	10.75
theta hat (KM)	1.916	theta star (KM)	2.238
80% gamma percentile (KM)	1.635	90% gamma percentile (KM)	2.772
95% gamma percentile (KM)	4.003	99% gamma percentile (KM)	7.062

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.75, α)	4.414	Adjusted Chi Square Value (10.75, β)	3.814
95% Gamma Approximate KM-UCL (use when n>=50)	2.44	95% Gamma Adjusted KM-UCL (use when n<50)	2.824

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.859	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.28	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.967	Mean in Log Scale	-0.75
SD in Original Scale	1.453	SD in Log Scale	1.191
95% t UCL (assumes normality of ROS data)	1.721	95% Percentile Bootstrap UCL	1.673
95% BCA Bootstrap UCL	2.065	95% Bootstrap t UCL	3.125
95% H-UCL (Log ROS)	3.112		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.634	KM Geo Mean	0.531
KM SD (logged)	1.043	95% Critical H Value (KM-Log)	2.993
KM Standard Error of Mean (logged)	0.355	95% H-UCL (KM -Log)	2.343
KM SD (logged)	1.043	95% Critical H Value (KM-Log)	2.993
KM Standard Error of Mean (logged)	0.355		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.188	Mean in Log Scale	-0.447
SD in Original Scale	1.476	SD in Log Scale	1.19
95% t UCL (Assumes normality)	1.954	95% H-Stat UCL	4.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.797

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	7
Number of Detects	4	Number of Non-Detects	8
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	0.55	Minimum Non-Detect	0.13
Maximum Detect	2.4	Maximum Non-Detect	1
Variance Detects	0.735	Percent Non-Detects	66.67%
Mean Detects	1.168	SD Detects	0.857
Median Detects	0.86	CV Detects	0.734
Skewness Detects	1.558	Kurtosis Detects	2.194
Mean of Logged Detects	-0.0263	SD of Logged Detects	0.673

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.829	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.281	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.526	KM Standard Error of Mean	0.22
KM SD	0.639	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.921	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.888	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1.185	95% KM Chebyshev UCL	1.484
97.5% KM Chebyshev UCL	1.898	99% KM Chebyshev UCL	2.712

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.391	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.66	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.28	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.397	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	2.916	k star (bias corrected MLE)	0.896
Theta hat (MLE)	0.4	Theta star (bias corrected MLE)	1.303
nu hat (MLE)	23.33	nu star (bias corrected)	7.166
Mean (detects)	1.168		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.43
Maximum	2.4	Median	0.01
SD	0.714	CV	1.663
k hat (MLE)	0.35	k star (bias corrected MLE)	0.318
Theta hat (MLE)	1.229	Theta star (bias corrected MLE)	1.352
nu hat (MLE)	8.392	nu star (bias corrected)	7.627
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (7.63, α)	2.521	Adjusted Chi Square Value (7.63, β)	2.096
95% Gamma Approximate UCL (use when n>=50)	1.3	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.526	SD (KM)	0.639
Variance (KM)	0.409	SE of Mean (KM)	0.22
k hat (KM)	0.678	k star (KM)	0.564
nu hat (KM)	16.28	nu star (KM)	13.54
theta hat (KM)	0.776	theta star (KM)	0.933
80% gamma percentile (KM)	0.867	90% gamma percentile (KM)	1.388
95% gamma percentile (KM)	1.936	99% gamma percentile (KM)	3.271

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (13.54, α)	6.259	Adjusted Chi Square Value (13.54, β)	5.521
95% Gamma Approximate KM-UCL (use when n>=50)	1.139	95% Gamma Adjusted KM-UCL (use when n<50)	1.291

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.249	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.535	Mean in Log Scale	-1.13
SD in Original Scale	0.657	SD in Log Scale	1.006
95% t UCL (assumes normality of ROS data)	0.875	95% Percentile Bootstrap UCL	0.87
95% BCA Bootstrap UCL	1.03	95% Bootstrap t UCL	1.444
95% H-UCL (Log ROS)	1.302		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.202	KM Geo Mean	0.301
KM SD (logged)	1.007	95% Critical H Value (KM-Log)	2.927
KM Standard Error of Mean (logged)	0.379	95% H-UCL (KM -Log)	1.214
KM SD (logged)	1.007	95% Critical H Value (KM-Log)	2.927
KM Standard Error of Mean (logged)	0.379		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.596	Mean in Log Scale	-0.959
SD in Original Scale	0.636	SD in Log Scale	1.014
95% t UCL (Assumes normality)	0.926	95% H-Stat UCL	1.575

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.921

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Bromodichloromethane

General Statistics

Total Number of Observations	12	Number of Distinct Observations	6
Number of Detects	1	Number of Non-Detects	11
Number of Distinct Detects	1	Number of Distinct Non-Detects	5

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Bromodichloromethane was not processed!

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chlorobenzene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	7
Number of Detects	4	Number of Non-Detects	8
Number of Distinct Detects	4	Number of Distinct Non-Detects	3
Minimum Detect	0.31	Minimum Non-Detect	0.14
Maximum Detect	130	Maximum Non-Detect	1
Variance Detects	3901	Percent Non-Detects	66.67%
Mean Detects	36.5	SD Detects	62.46
Median Detects	7.85	CV Detects	1.711
Skewness Detects	1.976	Kurtosis Detects	3.92
Mean of Logged Detects	1.935	SD of Logged Detects	2.478

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.69	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.414	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	12.31	KM Standard Error of Mean	11.87
KM SD	35.61	95% KM (BCA) UCL	N/A
95% KM (t) UCL	33.63	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	31.83	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	47.92	95% KM Chebyshev UCL	64.05
97.5% KM Chebyshev UCL	86.43	99% KM Chebyshev UCL	130.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.314	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.693	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.297	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.414	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.396	k star (bias corrected MLE)	0.266
Theta hat (MLE)	92.09	Theta star (bias corrected MLE)	137.3
nu hat (MLE)	3.171	nu star (bias corrected)	2.126
Mean (detects)	36.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	12.17
Maximum	130	Median	0.01
SD	37.24	CV	3.059
k hat (MLE)	0.155	k star (bias corrected MLE)	0.172
Theta hat (MLE)	78.4	Theta star (bias corrected MLE)	70.77
nu hat (MLE)	3.727	nu star (bias corrected)	4.128
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (4.13, α)	0.773	Adjusted Chi Square Value (4.13, β)	0.582
95% Gamma Approximate UCL (use when n>=50)	65.01	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chlorobenzene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	12.31	SD (KM)	35.61
Variance (KM)	1268	SE of Mean (KM)	11.87
k hat (KM)	0.12	k star (KM)	0.145
nu hat (KM)	2.869	nu star (KM)	3.485
theta hat (KM)	103	theta star (KM)	84.78
80% gamma percentile (KM)	13.04	90% gamma percentile (KM)	36.33
95% gamma percentile (KM)	68.18	99% gamma percentile (KM)	161.2

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.48, α)	0.529	Adjusted Chi Square Value (3.48, β)	0.387
95% Gamma Approximate KM-UCL (use when n>=50)	81.02	95% Gamma Adjusted KM-UCL (use when n<50)	110.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.978	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.219	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	12.23	Mean in Log Scale	-1.863
SD in Original Scale	37.22	SD in Log Scale	3.507
95% t UCL (assumes normality of ROS data)	31.53	95% Percentile Bootstrap UCL	33.07
95% BCA Bootstrap UCL	44.71	95% Bootstrap t UCL	281.2
95% H-UCL (Log ROS)	490704		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.434	KM Geo Mean	0.648
KM SD (logged)	2.108	95% Critical H Value (KM-Log)	5.198
KM Standard Error of Mean (logged)	0.735	95% H-UCL (KM -Log)	162.8
KM SD (logged)	2.108	95% Critical H Value (KM-Log)	5.198
KM Standard Error of Mean (logged)	0.735		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	12.38	Mean in Log Scale	-0.266
SD in Original Scale	37.17	SD in Log Scale	2.166
95% t UCL (Assumes normality)	31.65	95% H-Stat UCL	259.5

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Bootstrap t UCL	N/A	Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	110.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane)

General Statistics

Total Number of Observations	12	Number of Distinct Observations	6
Number of Detects	1	Number of Non-Detects	11
Number of Distinct Detects	1	Number of Distinct Non-Detects	5

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Chloroform (Trichloromethane) was not processed!

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	6
Number of Detects	2	Number of Non-Detects	10
Number of Distinct Detects	2	Number of Distinct Non-Detects	4
Minimum Detect	0.39	Minimum Non-Detect	0.11
Maximum Detect	4.5	Maximum Non-Detect	5
Variance Detects	8.446	Percent Non-Detects	83.33%
Mean Detects	2.445	SD Detects	2.906
Median Detects	2.445	CV Detects	1.189
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	0.281	SD of Logged Detects	1.729

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.56	KM Standard Error of Mean	0.535
KM SD	1.251	95% KM (BCA) UCL	N/A
95% KM (t) UCL	1.521	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	1.44	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	2.165	95% KM Chebyshev UCL	2.893
97.5% KM Chebyshev UCL	3.902	99% KM Chebyshev UCL	5.885

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.948	k star (bias corrected MLE)	N/A
Theta hat (MLE)	2.579	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	3.792	nu star (bias corrected)	N/A
Mean (detects)	2.445		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.56	SD (KM)	1.251
Variance (KM)	1.564	SE of Mean (KM)	0.535
k hat (KM)	0.201	k star (KM)	0.206
nu hat (KM)	4.813	nu star (KM)	4.943
theta hat (KM)	2.792	theta star (KM)	2.719
80% gamma percentile (KM)	0.749	90% gamma percentile (KM)	1.694
95% gamma percentile (KM)	2.863	99% gamma percentile (KM)	6.068

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.029
Approximate Chi Square Value (4.94, α)	1.126	Adjusted Chi Square Value (4.94, β)	0.876
95% Gamma Approximate KM-UCL (use when n>=50)	2.458	95% Gamma Adjusted KM-UCL (use when n<50)	3.159

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.437	Mean in Log Scale	-3.674
SD in Original Scale	1.285	SD in Log Scale	2.431
95% t UCL (assumes normality of ROS data)	1.103	95% Percentile Bootstrap UCL	1.162
95% BCA Bootstrap UCL	1.562	95% Bootstrap t UCL	9.742
95% H-UCL (Log ROS)	37.21		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Ethylbenzene (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.64	KM Geo Mean	0.194
KM SD (logged)	1.105	95% Critical H Value (KM-Log)	3.109
KM Standard Error of Mean (logged)	0.514	95% H-UCL (KM -Log)	1.007
KM SD (logged)	1.105	95% Critical H Value (KM-Log)	3.109
KM Standard Error of Mean (logged)	0.514		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.861	Mean in Log Scale	-0.917
SD in Original Scale	1.316	SD in Log Scale	1.25
95% t UCL (Assumes normality)	1.544	95% H-Stat UCL	3.132

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	3.902

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	12	Number of Distinct Observations	5
Number of Detects	1	Number of Non-Detects	11
Number of Distinct Detects	1	Number of Distinct Non-Detects	4

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Trichloroethene was not processed!

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride

General Statistics

Total Number of Observations	12	Number of Distinct Observations	7
Number of Detects	3	Number of Non-Detects	9
Number of Distinct Detects	3	Number of Distinct Non-Detects	5
Minimum Detect	0.27	Minimum Non-Detect	0.2
Maximum Detect	1.7	Maximum Non-Detect	5
Variance Detects	0.511	Percent Non-Detects	75%
Mean Detects	0.99	SD Detects	0.715
Median Detects	1	CV Detects	0.722
Skewness Detects	-0.0629	Kurtosis Detects	N/A
Mean of Logged Detects	-0.26	SD of Logged Detects	0.947

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	1	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.438	KM Standard Error of Mean	0.17
KM SD	0.456	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.743	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.717	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.947	95% KM Chebyshev UCL	1.178
97.5% KM Chebyshev UCL	1.499	99% KM Chebyshev UCL	2.128

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	2.156	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.459	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	12.93	nu star (bias corrected)	N/A
Mean (detects)	0.99		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.291
Maximum	1.7	Median	0.01
SD	0.527	CV	1.81
k hat (MLE)	0.377	k star (bias corrected MLE)	0.338
Theta hat (MLE)	0.773	Theta star (bias corrected MLE)	0.861
nu hat (MLE)	9.037	nu star (bias corrected)	8.111
Adjusted Level of Significance (β)	0.029		
Approximate Chi Square Value (8.11, α)	2.799	Adjusted Chi Square Value (8.11, β)	2.346
95% Gamma Approximate UCL (use when n>=50)	0.843	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vinyl chloride (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.438	SD (KM)	0.456
Variance (KM)	0.208	SE of Mean (KM)	0.17
k hat (KM)	0.92	k star (KM)	0.746
nu hat (KM)	22.09	nu star (KM)	17.9
theta hat (KM)	0.476	theta star (KM)	0.587
80% gamma percentile (KM)	0.718	90% gamma percentile (KM)	1.082
95% gamma percentile (KM)	1.456	99% gamma percentile (KM)	2.344

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (17.90, α)	9.317	Adjusted Chi Square Value (17.90, β)	8.387
95% Gamma Approximate KM-UCL (use when n>=50)	0.841	95% Gamma Adjusted KM-UCL (use when n<50)	0.934

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.275	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.353	Mean in Log Scale	-1.676
SD in Original Scale	0.496	SD in Log Scale	1.1
95% t UCL (assumes normality of ROS data)	0.61	95% Percentile Bootstrap UCL	0.609
95% BCA Bootstrap UCL	0.698	95% Bootstrap t UCL	1.506
95% H-UCL (Log ROS)	0.957		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.146	KM Geo Mean	0.318
KM SD (logged)	0.688	95% Critical H Value (KM-Log)	2.397
KM Standard Error of Mean (logged)	0.271	95% H-UCL (KM -Log)	0.663
KM SD (logged)	0.688	95% Critical H Value (KM-Log)	2.397
KM Standard Error of Mean (logged)	0.271		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.679	Mean in Log Scale	-0.803
SD in Original Scale	0.723	SD in Log Scale	0.922
95% t UCL (Assumes normality)	1.054	95% H-Stat UCL	1.484

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.743

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

bis(2-Ethylhexyl)phthalate (DEHP)

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	7
Number of Detects	1	Number of Non-Detects	4
Number of Distinct Detects	1	Number of Distinct Non-Detects	3

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable bis(2-Ethylhexyl)phthalate (DEHP) was not processed!

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene

General Statistics

Total Number of Observations	7	Number of Distinct Observations	6
		Number of Missing Observations	5
Number of Detects	3	Number of Non-Detects	4
Number of Distinct Detects	3	Number of Distinct Non-Detects	3
Minimum Detect	1.2	Minimum Non-Detect	0.064
Maximum Detect	4.9	Maximum Non-Detect	0.2
Variance Detects	3.863	Percent Non-Detects	57.14%
Mean Detects	2.667	SD Detects	1.966
Median Detects	1.9	CV Detects	0.737
Skewness Detects	1.488	Kurtosis Detects	N/A
Mean of Logged Detects	0.804	SD of Logged Detects	0.717

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.886	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.318	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.179	KM Standard Error of Mean	0.769
KM SD	1.662	95% KM (BCA) UCL	N/A
95% KM (t) UCL	2.675	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	2.445	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	3.488	95% KM Chebyshev UCL	4.533
97.5% KM Chebyshev UCL	5.984	99% KM Chebyshev UCL	8.835

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	2.991	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.891	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	17.95	nu star (bias corrected)	N/A
Mean (detects)	2.667		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.149
Maximum	4.9	Median	0.01
SD	1.818	CV	1.583
k hat (MLE)	0.286	k star (bias corrected MLE)	0.259
Theta hat (MLE)	4.009	Theta star (bias corrected MLE)	4.436
nu hat (MLE)	4.011	nu star (bias corrected)	3.625
Adjusted Level of Significance (β)	0.0158		
Approximate Chi Square Value (3.63, α)	0.579	Adjusted Chi Square Value (3.63, β)	0.31
95% Gamma Approximate UCL (use when n>=50)	7.186	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Naphthalene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.179	SD (KM)	1.662
Variance (KM)	2.763	SE of Mean (KM)	0.769
k hat (KM)	0.504	k star (KM)	0.383
nu hat (KM)	7.049	nu star (KM)	5.361
theta hat (KM)	2.342	theta star (KM)	3.08
80% gamma percentile (KM)	1.893	90% gamma percentile (KM)	3.357
95% gamma percentile (KM)	4.974	99% gamma percentile (KM)	9.062

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.36, α)	1.323	Adjusted Chi Square Value (5.36, β)	0.813
95% Gamma Approximate KM-UCL (use when n>=50)	4.781	95% Gamma Adjusted KM-UCL (use when n<50)	7.778

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.961	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.256	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.247	Mean in Log Scale	-0.667
SD in Original Scale	1.748	SD in Log Scale	1.469
95% t UCL (assumes normality of ROS data)	2.53	95% Percentile Bootstrap UCL	2.366
95% BCA Bootstrap UCL	2.864	95% Bootstrap t UCL	5.361
95% H-UCL (Log ROS)	31.89		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.226	KM Geo Mean	0.293
KM SD (logged)	1.8	95% Critical H Value (KM-Log)	6.116
KM Standard Error of Mean (logged)	0.833	95% H-UCL (KM -Log)	132.6
KM SD (logged)	1.8	95% Critical H Value (KM-Log)	6.116
KM Standard Error of Mean (logged)	0.833		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.183	Mean in Log Scale	-1.233
SD in Original Scale	1.793	SD in Log Scale	1.99
95% t UCL (Assumes normality)	2.5	95% H-Stat UCL	493.8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.675

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	820	Mean	6844
Maximum	15000	Median	6200
SD	5771	Std. Error of Mean	2581
Coefficient of Variation	0.843	Skewness	0.56

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.951	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.184	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	12346	95% Adjusted-CLT UCL (Chen-1995)	11780
		95% Modified-t UCL (Johnson-1978)	12454

Gamma GOF Test

A-D Test Statistic	0.216	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.688	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.174	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.363	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.3	k star (bias corrected MLE)	0.653
Theta hat (MLE)	5263	Theta star (bias corrected MLE)	10474
nu hat (MLE)	13	nu star (bias corrected)	6.534
MLE Mean (bias corrected)	6844	MLE Sd (bias corrected)	8467
		Approximate Chi Square Value (0.05)	1.919
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	1.018

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	23307	95% Adjusted Gamma UCL (use when n<50)	43937

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.945	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.211	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	6.709	Mean of logged Data	8.4
Maximum of Logged Data	9.616	SD of logged Data	1.175

Assuming Lognormal Distribution

95% H-UCL	247636	90% Chebyshev (MVUE) UCL	18368
95% Chebyshev (MVUE) UCL	23337	97.5% Chebyshev (MVUE) UCL	30235
99% Chebyshev (MVUE) UCL	43784		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	11089	95% Jackknife UCL	12346
95% Standard Bootstrap UCL	10604	95% Bootstrap-t UCL	14473
95% Hall's Bootstrap UCL	14179	95% Percentile Bootstrap UCL	10700
95% BCA Bootstrap UCL	10920		
90% Chebyshev(Mean, Sd) UCL	14586	95% Chebyshev(Mean, Sd) UCL	18093
97.5% Chebyshev(Mean, Sd) UCL	22961	99% Chebyshev(Mean, Sd) UCL	32523

Suggested UCL to Use

95% Student's-t UCL	12346

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	5
Number of Detects	3	Number of Non-Detects	2
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	1.2	Minimum Non-Detect	0.57
Maximum Detect	13	Maximum Non-Detect	0.57
Variance Detects	42.49	Percent Non-Detects	40%
Mean Detects	5.5	SD Detects	6.518
Median Detects	2.3	CV Detects	1.185
Skewness Detects	1.677	Kurtosis Detects	N/A
Mean of Logged Detects	1.193	SD of Logged Detects	1.232

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.355	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	3.528	KM Standard Error of Mean	2.617
KM SD	4.778	95% KM (BCA) UCL	N/A
95% KM (t) UCL	9.107	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	7.833	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	11.38	95% KM Chebyshev UCL	14.94
97.5% KM Chebyshev UCL	19.87	99% KM Chebyshev UCL	29.57

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	1.115	k star (bias corrected MLE)	N/A
Theta hat (MLE)	4.933	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	6.69	nu star (bias corrected)	N/A
Mean (detects)	5.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	3.304
Maximum	13	Median	1.2
SD	5.503	CV	1.666
k hat (MLE)	0.297	k star (bias corrected MLE)	0.252
Theta hat (MLE)	11.11	Theta star (bias corrected MLE)	13.09
nu hat (MLE)	2.975	nu star (bias corrected)	2.523
Adjusted Level of Significance (β)	0.0086		
Approximate Chi Square Value (2.52, α)	0.246	Adjusted Chi Square Value (2.52, β)	0.0957
95% Gamma Approximate UCL (use when n>=50)	33.83	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	3.528	SD (KM)	4.778
Variance (KM)	22.83	SE of Mean (KM)	2.617
k hat (KM)	0.545	k star (KM)	0.351
nu hat (KM)	5.452	nu star (KM)	3.514
theta hat (KM)	6.471	theta star (KM)	10.04
80% gamma percentile (KM)	5.59	90% gamma percentile (KM)	10.18
95% gamma percentile (KM)	15.32	99% gamma percentile (KM)	28.43

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.51, α)	0.54	Adjusted Chi Square Value (3.51, β)	0.21
95% Gamma Approximate KM-UCL (use when n>=50)	22.97	95% Gamma Adjusted KM-UCL (use when n<50)	59.17

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.282	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	3.336	Mean in Log Scale	-0.322
SD in Original Scale	5.479	SD in Log Scale	2.297
95% t UCL (assumes normality of ROS data)	8.56	95% Percentile Bootstrap UCL	7.857
95% BCA Bootstrap UCL	8.288	95% Bootstrap t UCL	28.85
95% H-UCL (Log ROS)	2301170		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.491	KM Geo Mean	1.634
KM SD (logged)	1.16	95% Critical H Value (KM-Log)	5.603
KM Standard Error of Mean (logged)	0.636	95% H-UCL (KM -Log)	82.68
KM SD (logged)	1.16	95% Critical H Value (KM-Log)	5.603
KM Standard Error of Mean (logged)	0.636		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.414	Mean in Log Scale	0.214
SD in Original Scale	5.423	SD in Log Scale	1.599
95% t UCL (Assumes normality)	8.584	95% H-Stat UCL	1886

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	9.107

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	5
Minimum	3.2	Mean	28.39
Maximum	66.2	Median	23
SD	22.25	Std. Error of Mean	8.41
Coefficient of Variation	0.784	Skewness	0.762

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.189	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	44.73	95% Adjusted-CLT UCL (Chen-1995)	44.81
		95% Modified-t UCL (Johnson-1978)	45.13

Gamma GOF Test

A-D Test Statistic	0.211	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.721	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.187	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.317	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.488	k star (bias corrected MLE)	0.946
Theta hat (MLE)	19.07	Theta star (bias corrected MLE)	30.01
nu hat (MLE)	20.84	nu star (bias corrected)	13.24
MLE Mean (bias corrected)	28.39	MLE Sd (bias corrected)	29.19
		Approximate Chi Square Value (0.05)	6.055
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	4.67

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	62.07	95% Adjusted Gamma UCL (use when n<50)	80.48

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.241	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.163	Mean of logged Data	2.974
Maximum of Logged Data	4.193	SD of logged Data	1.056

Assuming Lognormal Distribution

95% H-UCL	180.6	90% Chebyshev (MVUE) UCL	67.73
95% Chebyshev (MVUE) UCL	84.46	97.5% Chebyshev (MVUE) UCL	107.7
99% Chebyshev (MVUE) UCL	153.3		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	42.22	95% Jackknife UCL	44.73
95% Standard Bootstrap UCL	41.33	95% Bootstrap-t UCL	53.06
95% Hall's Bootstrap UCL	64.59	95% Percentile Bootstrap UCL	41.63
95% BCA Bootstrap UCL	43.84		
90% Chebyshev(Mean, Sd) UCL	53.62	95% Chebyshev(Mean, Sd) UCL	65.04
97.5% Chebyshev(Mean, Sd) UCL	80.91	99% Chebyshev(Mean, Sd) UCL	112.1

Suggested UCL to Use

95% Student's-t UCL	44.73

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	290	Mean	656
Maximum	1500	Median	500
SD	481.3	Std. Error of Mean	215.2
Coefficient of Variation	0.734	Skewness	2.011

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.736	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1115	95% Adjusted-CLT UCL (Chen-1995)	1217
		95% Modified-t UCL (Johnson-1978)	1147

Gamma GOF Test

A-D Test Statistic	0.57	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.682	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.357	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.359	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.161	k star (bias corrected MLE)	1.398
Theta hat (MLE)	207.6	Theta star (bias corrected MLE)	469.4
nu hat (MLE)	31.61	nu star (bias corrected)	13.98
MLE Mean (bias corrected)	656	MLE Sd (bias corrected)	554.9
		Approximate Chi Square Value (0.05)	6.555
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	4.513

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	1399	95% Adjusted Gamma UCL (use when n<50)	2032

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.319	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.67	Mean of logged Data	6.32
Maximum of Logged Data	7.313	SD of logged Data	0.605

Assuming Lognormal Distribution

95% H-UCL	1814	90% Chebyshev (MVUE) UCL	1154
95% Chebyshev (MVUE) UCL	1387	97.5% Chebyshev (MVUE) UCL	1709
99% Chebyshev (MVUE) UCL	2343		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1010	95% Jackknife UCL	1115
95% Standard Bootstrap UCL	971.3	95% Bootstrap-t UCL	2599
95% Hall's Bootstrap UCL	3173	95% Percentile Bootstrap UCL	1048
95% BCA Bootstrap UCL	1098		
90% Chebyshev(Mean, Sd) UCL	1302	95% Chebyshev(Mean, Sd) UCL	1594
97.5% Chebyshev(Mean, Sd) UCL	2000	99% Chebyshev(Mean, Sd) UCL	2798

Suggested UCL to Use

95% Adjusted Gamma UCL	2032

Recommended UCL exceeds the maximum observation

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	5
Number of Detects	3	Number of Non-Detects	2
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	0.38	Minimum Non-Detect	0.21
Maximum Detect	4	Maximum Non-Detect	0.21
Variance Detects	4.344	Percent Non-Detects	40%
Mean Detects	1.593	SD Detects	2.084
Median Detects	0.4	CV Detects	1.308
Skewness Detects	1.732	Kurtosis Detects	N/A
Mean of Logged Detects	-0.166	SD of Logged Detects	1.344

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.754	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.383	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.04	KM Standard Error of Mean	0.812
KM SD	1.482	95% KM (BCA) UCL	N/A
95% KM (t) UCL	2.771	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	2.375	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	3.476	95% KM Chebyshev UCL	4.579
97.5% KM Chebyshev UCL	6.11	99% KM Chebyshev UCL	9.118

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	0.923	k star (bias corrected MLE)	N/A
Theta hat (MLE)	1.727	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	5.536	nu star (bias corrected)	N/A
Mean (detects)	1.593		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.96
Maximum	4	Median	0.38
SD	1.71	CV	1.781
k hat (MLE)	0.353	k star (bias corrected MLE)	0.275
Theta hat (MLE)	2.718	Theta star (bias corrected MLE)	3.496
nu hat (MLE)	3.532	nu star (bias corrected)	2.746
Adjusted Level of Significance (β)	0.0086		
Approximate Chi Square Value (2.75, α)	0.301	Adjusted Chi Square Value (2.75, β)	0.113
95% Gamma Approximate UCL (use when n>=50)	8.747	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.04	SD (KM)	1.482
Variance (KM)	2.197	SE of Mean (KM)	0.812
k hat (KM)	0.492	k star (KM)	0.33
nu hat (KM)	4.923	nu star (KM)	3.303
theta hat (KM)	2.112	theta star (KM)	3.149
80% gamma percentile (KM)	1.629	90% gamma percentile (KM)	3.029
95% gamma percentile (KM)	4.611	99% gamma percentile (KM)	8.674

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (3.30, α)	0.467	Adjusted Chi Square Value (3.30, β)	0.178
95% Gamma Approximate KM-UCL (use when n>=50)	7.348	95% Gamma Adjusted KM-UCL (use when n<50)	19.33

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.766	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.378	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.965	Mean in Log Scale	-1.694
SD in Original Scale	1.707	SD in Log Scale	2.344
95% t UCL (assumes normality of ROS data)	2.592	95% Percentile Bootstrap UCL	2.409
95% BCA Bootstrap UCL	2.487	95% Bootstrap t UCL	9.812
95% H-UCL (Log ROS)	1081306		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.724	KM Geo Mean	0.485
KM SD (logged)	1.091	95% Critical H Value (KM-Log)	5.299
KM Standard Error of Mean (logged)	0.597	95% H-UCL (KM -Log)	15.82
KM SD (logged)	1.091	95% Critical H Value (KM-Log)	5.299
KM Standard Error of Mean (logged)	0.597		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.998	Mean in Log Scale	-1.001
SD in Original Scale	1.684	SD in Log Scale	1.487
95% t UCL (Assumes normality)	2.604	95% H-Stat UCL	211.8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	2.771

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	1.3	Mean	21.86
Maximum	36	Median	33
SD	17.6	Std. Error of Mean	7.869
Coefficient of Variation	0.805	Skewness	-0.605

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.753	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.337	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	38.64	95% Adjusted-CLT UCL (Chen-1995)	32.53
		95% Modified-t UCL (Johnson-1978)	38.28

Gamma GOF Test

A-D Test Statistic	0.712	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.693	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.378	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.365	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.928	k star (bias corrected MLE)	0.504
Theta hat (MLE)	23.56	Theta star (bias corrected MLE)	43.34
nu hat (MLE)	9.277	nu star (bias corrected)	5.044
MLE Mean (bias corrected)	21.86	MLE Sd (bias corrected)	30.78
		Approximate Chi Square Value (0.05)	1.173
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.547

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	94.04	95% Adjusted Gamma UCL (use when n<50)	201.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.783	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.35	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data Not Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.262	Mean of logged Data	2.457
Maximum of Logged Data	3.584	SD of logged Data	1.543

Assuming Lognormal Distribution

95% H-UCL	10791	90% Chebyshev (MVUE) UCL	76.74
95% Chebyshev (MVUE) UCL	99.31	97.5% Chebyshev (MVUE) UCL	130.6
99% Chebyshev (MVUE) UCL	192.2		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	34.8	95% Jackknife UCL	38.64
95% Standard Bootstrap UCL	33.3	95% Bootstrap-t UCL	36.96
95% Hall's Bootstrap UCL	27.51	95% Percentile Bootstrap UCL	34.4
95% BCA Bootstrap UCL	33.4		
90% Chebyshev(Mean, Sd) UCL	45.47	95% Chebyshev(Mean, Sd) UCL	56.16
97.5% Chebyshev(Mean, Sd) UCL	71	99% Chebyshev(Mean, Sd) UCL	100.2

Suggested UCL to Use

95% Student's-t UCL	38.64

Recommended UCL exceeds the maximum observation

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	0.89	Mean	6.278
Maximum	14	Median	4.7
SD	5.384	Std. Error of Mean	2.408
Coefficient of Variation	0.858	Skewness	0.727

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.215	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	11.41	95% Adjusted-CLT UCL (Chen-1995)	11.07
		95% Modified-t UCL (Johnson-1978)	11.54

Gamma GOF Test

A-D Test Statistic	0.193	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.687	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.184	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.362	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.394	k star (bias corrected MLE)	0.691
Theta hat (MLE)	4.504	Theta star (bias corrected MLE)	9.087
nu hat (MLE)	13.94	nu star (bias corrected)	6.908
MLE Mean (bias corrected)	6.278	MLE Sd (bias corrected)	7.553
		Approximate Chi Square Value (0.05)	2.12
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	1.153

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	20.45	95% Adjusted Gamma UCL (use when n<50)	37.61

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.966	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.168	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.117	Mean of logged Data	1.437
Maximum of Logged Data	2.639	SD of logged Data	1.099

Assuming Lognormal Distribution

95% H-UCL	144.4	90% Chebyshev (MVUE) UCL	15.83
95% Chebyshev (MVUE) UCL	20.01	97.5% Chebyshev (MVUE) UCL	25.82
99% Chebyshev (MVUE) UCL	37.22		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	10.24	95% Jackknife UCL	11.41
95% Standard Bootstrap UCL	9.803	95% Bootstrap-t UCL	16.94
95% Hall's Bootstrap UCL	35.06	95% Percentile Bootstrap UCL	9.84
95% BCA Bootstrap UCL	10.3		
90% Chebyshev(Mean, Sd) UCL	13.5	95% Chebyshev(Mean, Sd) UCL	16.77
97.5% Chebyshev(Mean, Sd) UCL	21.31	99% Chebyshev(Mean, Sd) UCL	30.23

Suggested UCL to Use

95% Student's-t UCL	11.41

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	1.8	Mean	52.34
Maximum	170	Median	24
SD	69.3	Std. Error of Mean	30.99
Coefficient of Variation	1.324	Skewness	1.74

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.799	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.267	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	118.4	95% Adjusted-CLT UCL (Chen-1995)	129.1
		95% Modified-t UCL (Johnson-1978)	122.4

Gamma GOF Test

A-D Test Statistic	0.182	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.704	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.161	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.369	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.643	k star (bias corrected MLE)	0.39
Theta hat (MLE)	81.45	Theta star (bias corrected MLE)	134.1
nu hat (MLE)	6.426	nu star (bias corrected)	3.904
MLE Mean (bias corrected)	52.34	MLE Sd (bias corrected)	83.77
		Approximate Chi Square Value (0.05)	0.684
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.278

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	298.7	95% Adjusted Gamma UCL (use when n<50)	734

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.989	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.588	Mean of logged Data	3.006
Maximum of Logged Data	5.136	SD of logged Data	1.761

Assuming Lognormal Distribution

95% H-UCL	142390	90% Chebyshev (MVUE) UCL	176.4
95% Chebyshev (MVUE) UCL	230	97.5% Chebyshev (MVUE) UCL	304.4
99% Chebyshev (MVUE) UCL	450.5		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	103.3	95% Jackknife UCL	118.4
95% Standard Bootstrap UCL	97.99	95% Bootstrap-t UCL	317.8
95% Hall's Bootstrap UCL	369.8	95% Percentile Bootstrap UCL	107.2
95% BCA Bootstrap UCL	115.2		
90% Chebyshev(Mean, Sd) UCL	145.3	95% Chebyshev(Mean, Sd) UCL	187.4
97.5% Chebyshev(Mean, Sd) UCL	245.9	99% Chebyshev(Mean, Sd) UCL	360.7

Suggested UCL to Use

95% Student's-t UCL	118.4

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	2000	Mean	18500
Maximum	35000	Median	19000
SD	15190	Std. Error of Mean	6793
Coefficient of Variation	0.821	Skewness	-0.0337

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.884	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.222	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	32982	95% Adjusted-CLT UCL (Chen-1995)	29565
		95% Modified-t UCL (Johnson-1978)	32965

Gamma GOF Test

A-D Test Statistic	0.408	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.69	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.233	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.363	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.169	k star (bias corrected MLE)	0.601
Theta hat (MLE)	15826	Theta star (bias corrected MLE)	30786
nu hat (MLE)	11.69	nu star (bias corrected)	6.009
MLE Mean (bias corrected)	18500	MLE Sd (bias corrected)	23865
		Approximate Chi Square Value (0.05)	1.645
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.839

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	67599	95% Adjusted Gamma UCL (use when n<50)	132570

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.871	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.256	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.601	Mean of logged Data	9.34
Maximum of Logged Data	10.46	SD of logged Data	1.273

Assuming Lognormal Distribution

95% H-UCL	1241790	90% Chebyshev (MVUE) UCL	53148
95% Chebyshev (MVUE) UCL	67918	97.5% Chebyshev (MVUE) UCL	88418
99% Chebyshev (MVUE) UCL	128687		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	29674	95% Jackknife UCL	32982
95% Standard Bootstrap UCL	28144	95% Bootstrap-t UCL	34121
95% Hall's Bootstrap UCL	30260	95% Percentile Bootstrap UCL	28000
95% BCA Bootstrap UCL	28000		
90% Chebyshev(Mean, Sd) UCL	38880	95% Chebyshev(Mean, Sd) UCL	48112
97.5% Chebyshev(Mean, Sd) UCL	60925	99% Chebyshev(Mean, Sd) UCL	86093

Suggested UCL to Use

95% Student's-t UCL	32982

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	7	Number of Distinct Observations	7
		Number of Missing Observations	5
Minimum	1.3	Mean	93.63
Maximum	340	Median	27
SD	126.4	Std. Error of Mean	47.78
Coefficient of Variation	1.35	Skewness	1.53

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.794	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.272	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	186.5	95% Adjusted-CLT UCL (Chen-1995)	201.7
		95% Modified-t UCL (Johnson-1978)	191.1

Gamma GOF Test

A-D Test Statistic	0.234	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.755	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.16	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.328	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.479	k star (bias corrected MLE)	0.369
Theta hat (MLE)	195.6	Theta star (bias corrected MLE)	253.9
nu hat (MLE)	6.702	nu star (bias corrected)	5.163
MLE Mean (bias corrected)	93.63	MLE Sd (bias corrected)	154.2
		Approximate Chi Square Value (0.05)	1.228
Adjusted Level of Significance	0.0158	Adjusted Chi Square Value	0.745

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	393.6	95% Adjusted Gamma UCL (use when n<50)	648.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.803	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.304	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.262	Mean of logged Data	3.203
Maximum of Logged Data	5.829	SD of logged Data	2.154

Assuming Lognormal Distribution

95% H-UCL	145300	90% Chebyshev (MVUE) UCL	412.3
95% Chebyshev (MVUE) UCL	540.7	97.5% Chebyshev (MVUE) UCL	718.9
99% Chebyshev (MVUE) UCL	1069		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	172.2	95% Jackknife UCL	186.5
95% Standard Bootstrap UCL	164.7	95% Bootstrap-t UCL	367.6
95% Hall's Bootstrap UCL	495.6	95% Percentile Bootstrap UCL	175.9
95% BCA Bootstrap UCL	188.6		
90% Chebyshev(Mean, Sd) UCL	237	95% Chebyshev(Mean, Sd) UCL	301.9
97.5% Chebyshev(Mean, Sd) UCL	392	99% Chebyshev(Mean, Sd) UCL	569

Suggested UCL to Use

95% Student's-t UCL	186.5

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	170	Mean	654
Maximum	1300	Median	580
SD	491.2	Std. Error of Mean	219.7
Coefficient of Variation	0.751	Skewness	0.406

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1122	95% Adjusted-CLT UCL (Chen-1995)	1058
		95% Modified-t UCL (Johnson-1978)	1129

Gamma GOF Test

A-D Test Statistic	0.326	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.685	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.242	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.361	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.879	k star (bias corrected MLE)	0.885
Theta hat (MLE)	348	Theta star (bias corrected MLE)	738.9
nu hat (MLE)	18.79	nu star (bias corrected)	8.851
MLE Mean (bias corrected)	654	MLE Sd (bias corrected)	695.2
		Approximate Chi Square Value (0.05)	3.237
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	1.943

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1788	95% Adjusted Gamma UCL (use when n<50)	2979

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.907	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.213	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.136	Mean of logged Data	6.194
Maximum of Logged Data	7.17	SD of logged Data	0.902

Assuming Lognormal Distribution

95% H-UCL	5553	90% Chebyshev (MVUE) UCL	1448
95% Chebyshev (MVUE) UCL	1802	97.5% Chebyshev (MVUE) UCL	2292
99% Chebyshev (MVUE) UCL	3256		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1015	95% Jackknife UCL	1122
95% Standard Bootstrap UCL	980.7	95% Bootstrap-t UCL	1358
95% Hall's Bootstrap UCL	1265	95% Percentile Bootstrap UCL	976
95% BCA Bootstrap UCL	964		
90% Chebyshev(Mean, Sd) UCL	1313	95% Chebyshev(Mean, Sd) UCL	1612
97.5% Chebyshev(Mean, Sd) UCL	2026	99% Chebyshev(Mean, Sd) UCL	2840

Suggested UCL to Use

95% Student's-t UCL	1122

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	3.2	Mean	20.86
Maximum	46	Median	13
SD	19.06	Std. Error of Mean	8.523
Coefficient of Variation	0.914	Skewness	0.611

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.875	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.26	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	39.03	95% Adjusted-CLT UCL (Chen-1995)	37.37
		95% Modified-t UCL (Johnson-1978)	39.42

Gamma GOF Test

A-D Test Statistic	0.307	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.689	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.231	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.363	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.256	k star (bias corrected MLE)	0.636
Theta hat (MLE)	16.6	Theta star (bias corrected MLE)	32.81
nu hat (MLE)	12.56	nu star (bias corrected)	6.358
MLE Mean (bias corrected)	20.86	MLE Sd (bias corrected)	26.16
		Approximate Chi Square Value (0.05)	1.826
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.956

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	72.65	95% Adjusted Gamma UCL (use when n<50)	138.7

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.936	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.209	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.163	Mean of logged Data	2.59
Maximum of Logged Data	3.829	SD of logged Data	1.137

Assuming Lognormal Distribution

95% H-UCL	579.2	90% Chebyshev (MVUE) UCL	52.51
95% Chebyshev (MVUE) UCL	66.55	97.5% Chebyshev (MVUE) UCL	86.04
99% Chebyshev (MVUE) UCL	124.3		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	34.88	95% Jackknife UCL	39.03
95% Standard Bootstrap UCL	33.31	95% Bootstrap-t UCL	71.21
95% Hall's Bootstrap UCL	82.12	95% Percentile Bootstrap UCL	35.4
95% BCA Bootstrap UCL	33.44		
90% Chebyshev(Mean, Sd) UCL	46.43	95% Chebyshev(Mean, Sd) UCL	58.01
97.5% Chebyshev(Mean, Sd) UCL	74.08	99% Chebyshev(Mean, Sd) UCL	105.7

Suggested UCL to Use

95% Student's-t UCL	39.03

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	5
Number of Detects	3	Number of Non-Detects	2
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	0.35	Minimum Non-Detect	0.2
Maximum Detect	0.58	Maximum Non-Detect	0.2
Variance Detects	0.0146	Percent Non-Detects	40%
Mean Detects	0.443	SD Detects	0.121
Median Detects	0.4	CV Detects	0.273
Skewness Detects	1.405	Kurtosis Detects	N/A
Mean of Logged Detects	-0.837	SD of Logged Detects	0.262

Warning: Data set has only 3 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.307	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.425	Detected Data appear Normal at 5% Significance Level	

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.346	KM Standard Error of Mean	0.0776
KM SD	0.142	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.511	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.474	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.579	95% KM Chebyshev UCL	0.684
97.5% KM Chebyshev UCL	0.831	99% KM Chebyshev UCL	1.118

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	21.43	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0207	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	128.6	nu star (bias corrected)	N/A
Mean (detects)	0.443		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0589	Mean	0.31
Maximum	0.58	Median	0.35
SD	0.205	CV	0.661
k hat (MLE)	2.054	k star (bias corrected MLE)	0.955
Theta hat (MLE)	0.151	Theta star (bias corrected MLE)	0.324
nu hat (MLE)	20.54	nu star (bias corrected)	9.551
Adjusted Level of Significance (β)	0.0086		
Approximate Chi Square Value (9.55, α)	3.663	Adjusted Chi Square Value (9.55, β)	2.258
95% Gamma Approximate UCL (use when n>=50)	0.808	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.346	SD (KM)	0.142
Variance (KM)	0.0201	SE of Mean (KM)	0.0776
k hat (KM)	5.967	k star (KM)	2.52
nu hat (KM)	59.67	nu star (KM)	25.2
theta hat (KM)	0.058	theta star (KM)	0.137
80% gamma percentile (KM)	0.504	90% gamma percentile (KM)	0.638
95% gamma percentile (KM)	0.764	99% gamma percentile (KM)	1.041

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (25.20, α)	14.76	Adjusted Chi Square Value (25.20, β)	11.43
95% Gamma Approximate KM-UCL (use when n>=50)	0.591	95% Gamma Adjusted KM-UCL (use when n<50)	0.763

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.767	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.286	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.425	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.344	Mean in Log Scale	-1.158
SD in Original Scale	0.161	SD in Log Scale	0.487
95% t UCL (assumes normality of ROS data)	0.498	95% Percentile Bootstrap UCL	0.452
95% BCA Bootstrap UCL	0.462	95% Bootstrap t UCL	0.521
95% H-UCL (Log ROS)	0.718		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.146	KM Geo Mean	0.318
KM SD (logged)	0.413	95% Critical H Value (KM-Log)	2.687
KM Standard Error of Mean (logged)	0.226	95% H-UCL (KM -Log)	0.603
KM SD (logged)	0.413	95% Critical H Value (KM-Log)	2.687
KM Standard Error of Mean (logged)	0.226		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.306	Mean in Log Scale	-1.423
SD in Original Scale	0.207	SD in Log Scale	0.824
95% t UCL (Assumes normality)	0.503	95% H-Stat UCL	1.877

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.511

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	5
Minimum	1.8	Mean	17.8
Maximum	37	Median	14
SD	15.59	Std. Error of Mean	6.972
Coefficient of Variation	0.876	Skewness	0.355

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest. For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012). Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test

Shapiro Wilk Test Statistic	0.903	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	32.66	95% Adjusted-CLT UCL (Chen-1995)	30.45
		95% Modified-t UCL (Johnson-1978)	32.85

Gamma GOF Test

A-D Test Statistic	0.28	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.69	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.23	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.364	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.148	k star (bias corrected MLE)	0.592
Theta hat (MLE)	15.51	Theta star (bias corrected MLE)	30.04
nu hat (MLE)	11.48	nu star (bias corrected)	5.925
MLE Mean (bias corrected)	17.8	MLE Sd (bias corrected)	23.13
		Approximate Chi Square Value (0.05)	1.602
Adjusted Level of Significance	0.0086	Adjusted Chi Square Value	0.811

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	65.85	95% Adjusted Gamma UCL (use when n<50)	130

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.762	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.196	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.343	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.588	Mean of logged Data	2.384
Maximum of Logged Data	3.611	SD of logged Data	1.269

Assuming Lognormal Distribution

95% H-UCL	1152	90% Chebyshev (MVUE) UCL	50.4
95% Chebyshev (MVUE) UCL	64.39	97.5% Chebyshev (MVUE) UCL	83.81
99% Chebyshev (MVUE) UCL	122		

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	29.27	95% Jackknife UCL	32.66
95% Standard Bootstrap UCL	27.86	95% Bootstrap-t UCL	44.9
95% Hall's Bootstrap UCL	43.03	95% Percentile Bootstrap UCL	28.76
95% BCA Bootstrap UCL	28.76		
90% Chebyshev(Mean, Sd) UCL	38.71	95% Chebyshev(Mean, Sd) UCL	48.19
97.5% Chebyshev(Mean, Sd) UCL	61.34	99% Chebyshev(Mean, Sd) UCL	87.17

Suggested UCL to Use

95% Student's-t UCL	32.66

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	5
Number of Detects	4	Number of Non-Detects	1
Number of Distinct Detects	3	Number of Distinct Non-Detects	1
Minimum Detect	360	Minimum Non-Detect	15
Maximum Detect	1200	Maximum Non-Detect	15
Variance Detects	158400	Percent Non-Detects	20%
Mean Detects	620	SD Detects	398
Median Detects	460	CV Detects	0.642
Skewness Detects	1.689	Kurtosis Detects	2.75
Mean of Logged Detects	6.298	SD of Logged Detects	0.568

Note: Sample size is small (e.g., <10), if data are collected using ISM approach, you should use guidance provided in ITRC Tech Reg Guide on ISM (ITRC, 2012) to compute statistics of interest.
For example, you may want to use Chebyshev UCL to estimate EPC (ITRC, 2012).
Chebyshev UCL can be computed using the Nonparametric and All UCL Options of ProUCL 5.1

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.31	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	499	KM Standard Error of Mean	202.4
KM SD	391.9	95% KM (BCA) UCL	N/A
95% KM (t) UCL	930.5	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	831.9	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	1106	95% KM Chebyshev UCL	1381
97.5% KM Chebyshev UCL	1763	99% KM Chebyshev UCL	2513

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.503	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.659	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.292	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.396	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.942	k star (bias corrected MLE)	1.152
Theta hat (MLE)	157.3	Theta star (bias corrected MLE)	538.1
nu hat (MLE)	31.54	nu star (bias corrected)	9.218
Mean (detects)	620		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	496
Maximum	1200	Median	360
SD	442.4	CV	0.892
k hat (MLE)	0.326	k star (bias corrected MLE)	0.264
Theta hat (MLE)	1523	Theta star (bias corrected MLE)	1882
nu hat (MLE)	3.256	nu star (bias corrected)	2.636
Adjusted Level of Significance (β)	0.0086		
Approximate Chi Square Value (2.64, α)	0.273	Adjusted Chi Square Value (2.64, β)	0.104
95% Gamma Approximate UCL (use when n>=50)	4785	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.22.2

Summary of ProUCL Output for EU01 & EU19 Groundwater (Upper Aquifer)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 11:19:07 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	499	SD (KM)	391.9
Variance (KM)	153604	SE of Mean (KM)	202.4
k hat (KM)	1.621	k star (KM)	0.782
nu hat (KM)	16.21	nu star (KM)	7.818
theta hat (KM)	307.8	theta star (KM)	638.3
80% gamma percentile (KM)	816.5	90% gamma percentile (KM)	1220
95% gamma percentile (KM)	1632	99% gamma percentile (KM)	2607

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.82, α)	2.63	Adjusted Chi Square Value (7.82, β)	1.506
95% Gamma Approximate KM-UCL (use when n>=50)	1483	95% Gamma Adjusted KM-UCL (use when n<50)	2590

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.266	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	521.5	Mean in Log Scale	6.007
SD in Original Scale	409.1	SD in Log Scale	0.814
95% t UCL (assumes normality of ROS data)	911.5	95% Percentile Bootstrap UCL	N/A
95% BCA Bootstrap UCL	N/A	95% Bootstrap t UCL	N/A
95% H-UCL (Log ROS)	3027		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.58	KM Geo Mean	265
KM SD (logged)	1.502	95% Critical H Value (KM-Log)	7.128
KM Standard Error of Mean (logged)	0.775	95% H-UCL (KM -Log)	172619
KM SD (logged)	1.502	95% Critical H Value (KM-Log)	7.128
KM Standard Error of Mean (logged)	0.775		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	497.5	Mean in Log Scale	5.441
SD in Original Scale	440.3	SD in Log Scale	1.977
95% t UCL (Assumes normality)	917.2	95% H-Stat UCL	15793835

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	930.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.1

Summary of ProUCL Input Data for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

			0	1	2	3	4	5	6	7	8	9
OU Designation:	**Sample Location:**	**Sample Date:**	Chloroform (Trichloromethane)	D_Chloroform (Trichloromethane)	Trichloroethene	D_Trichloroethene	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene
Floodplain	BH01-18	5/8/2018	0.31	0	0.33	0						
Floodplain	BH02-18	5/8/2018	0.31	0	0.52	0						
Floodplain	BH03-18	5/7/2018	0.31	0	12	1						
Floodplain	BH07-18	5/10/2018	0.31	0	0.33	0						
Floodplain	MW-102	5/11/2015	1	0	1.85	1						
Floodplain	MW-103	5/11/2015	1	0	0.54	1						
Floodplain	MW-201	5/15/2015	1	0	1.4	1						
Floodplain	MW-206	10/4/2017	0.31	0	0.33	0	0.031	0	0.054	0	0.041	0
Floodplain	MW-207	10/4/2017	0.31	0	0.33	0	0.029	0	0.051	0	0.039	0
Floodplain	MW-226	10/4/2017	0.31	0	0.33	0	0.029	0	0.05	0	0.038	0
Floodplain	VAS-39	1/22/2019	0.13	0	0.1	0	0.24	1	0.36	1	0.42	1
Floodplain	VAS-39	1/23/2019	0.13	0	0.1	0						
Floodplain	VAS-39	1/23/2019	0.13	0	0.21	1						
Floodplain	VAS-39	1/23/2019	0.45	1	0.67	1						
Floodplain	VAS-39	1/23/2019	0.13	0	1.8	1	0.17	0	0.17	0	0.15	0
Floodplain	VAS-39	1/29/2019	0.13	0	2.75	1						
Floodplain	VAS-39	2/4/2019	0.13	0	2.4	1						
Floodplain	VAS-39	2/5/2019	0.13	0	0.44	1						
Floodplain	VAS-39	2/5/2019	0.13	0	0.32	1						
Floodplain	VAS-39	2/5/2019	0.13	0	0.6	1						
Floodplain	VAS-39	2/20/2019	0.2	1	0.14	1						

Table B.23.1

Summary of ProUCL Input Data for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

		10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Sample Location:	**Sample Date:**	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Aluminum	D_Aluminum	Antimony	D_Antimony	Arsenic	D_Arsenic	Barium	D_Barium	Beryllium	D_Beryllium	Cadmium	D_Cadmium	Chromium	D_Chromium
BH01-18	5/8/2018			535	1	0.57	0	1.025	1	170	1	0.33	1	0.21	0	1.6	1
BH02-18	5/8/2018			5700	1	1.8	1	11	1	360	1	0.81	1	0.68	1	18	1
BH03-18	5/7/2018			790	1	1.3	1	0.75	0	250	1	0.35	1	0.31	1	3.2	1
BH07-18	5/10/2018			3200	1	0.57	0	2.9	0	190	1	0.52	0	0.21	0	30	0
MW-102	5/11/2015																
MW-103	5/11/2015																
MW-201	5/15/2015																
MW-206	10/4/2017	0.045	0	55	1	0.57	0	1.1	1	140	1	0.31	0	0.21	0	0.98	0
MW-207	10/4/2017	0.043	0	930	1	0.57	0	4.1	1	200	1	0.31	0	0.21	0	0.98	0
MW-226	10/4/2017	0.042	0	76	1	0.57	0	0.75	0	170	1	0.31	0	0.21	0	0.98	0
VAS-39	1/22/2019	0.32	1	6800	1	0.65	1	41	1	240	1	0.35	1	0.84	1	19	1
VAS-39	1/23/2019			340	1	0.57	0	17	1	140	1	0.31	0	0.21	0	0.98	0
VAS-39	1/23/2019			410	1	0.57	0	2.1	1	130	1	0.31	0	0.21	0	0.98	0
VAS-39	1/23/2019			160000	1	3.9	1	360	1	1900	1	8.5	1	3.6	1	290	1
VAS-39	1/23/2019	0.13	0	810	1	0.57	0	0.75	0	110	1	0.31	0	0.21	0	1.6	1
VAS-39	1/29/2019			170000	1	5.6	1	210	1	2400	1	12	1	4.2	1	495	1
VAS-39	2/4/2019			3400	1	0.57	0	2.8	1	160	1	0.31	0	0.21	0	11	1
VAS-39	2/5/2019			4200	1	0.57	0	7.4	1	270	1	0.31	0	0.21	0	16	1
VAS-39	2/5/2019			14000	1	0.71	1	12	1	330	1	0.6	1	0.39	1	64	1
VAS-39	2/5/2019			7200	1	0.57	0	8.4	1	270	1	0.32	1	0.21	0	33	1
VAS-39	2/20/2019			5200	1	0.57	0	7.1	1	230	1	0.64	1	0.21	1	18	1

Table B.23.1

Summary of ProUCL Input Data for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

		26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43
Sample Location:	**Sample Date:**	Cobalt	D_Cobalt	Copper	D_Copper	Iron	D_Iron	Lead	D_Lead	Manganese	D_Manganese	Mercury	D_Mercury	Nickel	D_Nickel	Selenium	D_Selenium	Thallium	D_Thallium
BH01-18	5/8/2018	1.1	1	3.65	1	1300	1	0.45	1	230	1	0.13	0	6.85	1	8.7	1	0.2	0
BH02-18	5/8/2018	4.4	1	330	1	15000	1	24	1	1700	1	0.13	0	40	1	15	1	0.66	1
BH03-18	5/7/2018	2.4	1	11	1	2400	1	1.2	1	280	1	0.13	0	18	1	7	1	0.3	1
BH07-18	5/10/2018	2.8	0	52	0	7300	0	3.8	1	220	0	0.13	0	32	0	2.9	0	0.2	0
MW-102	5/11/2015																		
MW-103	5/11/2015																		
MW-201	5/15/2015																		
MW-206	10/4/2017	0.24	1	2.2	1	47	0	0.45	1	190	1	0.13	0	1.5	0	1.9	1	0.2	0
MW-207	10/4/2017	0.99	1	1.9	1	3600	1	1.2	1	690	1	0.13	0	1.5	0	0.89	0	0.2	0
MW-226	10/4/2017	0.2	1	1.7	0	62	1	0.45	1	22	1	0.13	0	1.5	0	7.6	1	0.32	1
VAS-39	1/22/2019	6	1	50	1	26000	1	54	1	1800	1	0.13	0	14	1	1.1	1	0.2	0
VAS-39	1/23/2019	0.58	1	2.9	1	5000	1	4.1	1	670	1	0.13	0	2.2	1	0.89	0	0.2	0
VAS-39	1/23/2019	0.65	1	2.1	1	1200	1	1.7	1	250	1	0.13	0	1.6	1	0.89	0	0.2	0
VAS-39	1/23/2019	120	1	420	1	500000	1	290	1	7300	1	0.35	1	370	1	19	1	4.5	1
VAS-39	1/23/2019	1.9	1	2.1	1	970	1	1	1	130	1	0.13	0	3.4	1	0.89	0	0.23	1
VAS-39	1/29/2019	190	1	400	1	430000	1	325	1	7050	1	0.31	1	470	1	17	1	5.2	1
VAS-39	2/4/2019	2.4	1	6	1	7400	1	5.4	1	270	1	0.13	0	7.8	1	0.89	0	0.22	1
VAS-39	2/5/2019	2.3	1	10	1	16000	1	5.7	1	450	1	0.13	0	9.6	1	0.89	0	0.2	0
VAS-39	2/5/2019	7.3	1	31	1	42000	1	17	1	980	1	0.13	0	29	1	1.2	1	0.33	1
VAS-39	2/5/2019	3.7	1	17	1	26000	1	9.6	1	800	1	0.13	0	17	1	0.95	1	0.2	0
VAS-39	2/20/2019	3.5	1	12	1	18000	1	7.4	1	630	1	0.13	0	11	1	0.89	0	0.23	1

Table B.23.1

Summary of ProUCL Input Data for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

		44	45	46	47	48	49	50	51
Sample Location:	**Sample Date:**	Vanadium	D_Vanadium	Zinc	D_Zinc	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)	Aroclor-1260 (PCB-1260)	D_Aroclor-1260 (PCB-1260)
BH01-18	5/8/2018	1.35	1	15	0				
BH02-18	5/8/2018	13	1	310	1				
BH03-18	5/7/2018	2	1	17	1				
BH07-18	5/10/2018	7.5	0	170	0				
MW-102	5/11/2015								
MW-103	5/11/2015								
MW-201	5/15/2015								
MW-206	10/4/2017	0.82	0	15	0	0.053	0	0.042	0
MW-207	10/4/2017	2	1	16	1	0.049	0	0.039	0
MW-226	10/4/2017	0.82	0	15	0	0.048	0	0.038	0
VAS-39	1/22/2019	17	1	440	1	0.39	1	0.082	1
VAS-39	1/23/2019	0.91	1	490	1				
VAS-39	1/23/2019	0.91	1	420	1				
VAS-39	1/23/2019	370	1	1600	1				
VAS-39	1/23/2019	1.6	1	340	1	0.05	0	0.046	0
VAS-39	1/29/2019	460	1	4000	1				
VAS-39	2/4/2019	6.6	1	590	1				
VAS-39	2/5/2019	8.6	1	530	1				
VAS-39	2/5/2019	30	1	930	1				
VAS-39	2/5/2019	15	1	620	1				
VAS-39	2/20/2019	12	1	910	1				

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane)

General Statistics

Total Number of Observations	21	Number of Distinct Observations	5
Number of Detects	2	Number of Non-Detects	19
Number of Distinct Detects	2	Number of Distinct Non-Detects	3
Minimum Detect	0.2	Minimum Non-Detect	0.13
Maximum Detect	0.45	Maximum Non-Detect	1
Variance Detects	0.0313	Percent Non-Detects	90.48%
Mean Detects	0.325	SD Detects	0.177
Median Detects	0.325	CV Detects	0.544
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-1.204	SD of Logged Detects	0.573

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.154	KM Standard Error of Mean	0.0255
KM SD	0.0745	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.198	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.196	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.231	95% KM Chebyshev UCL	0.266
97.5% KM Chebyshev UCL	0.314	99% KM Chebyshev UCL	0.408

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	6.409	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0507	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	25.63	nu star (bias corrected)	N/A
Mean (detects)	0.325		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.154	SD (KM)	0.0745
Variance (KM)	0.00556	SE of Mean (KM)	0.0255
k hat (KM)	4.289	k star (KM)	3.708
nu hat (KM)	180.2	nu star (KM)	155.8
theta hat (KM)	0.036	theta star (KM)	0.0416
80% gamma percentile (KM)	0.215	90% gamma percentile (KM)	0.262
95% gamma percentile (KM)	0.305	99% gamma percentile (KM)	0.399

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0383
Approximate Chi Square Value (155.75, α)	127.9	Adjusted Chi Square Value (155.75, β)	126
95% Gamma Approximate KM-UCL (use when n>=50)	0.188	95% Gamma Adjusted KM-UCL (use when n<50)	0.191

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0729	Mean in Log Scale	-3.167
SD in Original Scale	0.0986	SD in Log Scale	1.035
95% t UCL (assumes normality of ROS data)	0.11	95% Percentile Bootstrap UCL	0.112
95% BCA Bootstrap UCL	0.128	95% Bootstrap t UCL	0.155
95% H-UCL (Log ROS)	0.132		

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chloroform (Trichloromethane) (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.931	KM Geo Mean	0.145
KM SD (logged)	0.302	95% Critical H Value (KM-Log)	1.834
KM Standard Error of Mean (logged)	0.107	95% H-UCL (KM -Log)	0.172
KM SD (logged)	0.302	95% Critical H Value (KM-Log)	1.834
KM Standard Error of Mean (logged)	0.107		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.182	Mean in Log Scale	-2.007
SD in Original Scale	0.159	SD in Log Scale	0.764
95% t UCL (Assumes normality)	0.242	95% H-Stat UCL	0.265

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	0.266

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene

General Statistics

Total Number of Observations	21	Number of Distinct Observations	16
Number of Detects	13	Number of Non-Detects	8
Number of Distinct Detects	13	Number of Distinct Non-Detects	3
Minimum Detect	0.14	Minimum Non-Detect	0.1
Maximum Detect	12	Maximum Non-Detect	0.52
Variance Detects	9.905	Percent Non-Detects	38.1%
Mean Detects	1.932	SD Detects	3.147
Median Detects	0.67	CV Detects	1.629
Skewness Detects	3.145	Kurtosis Detects	10.57
Mean of Logged Detects	-0.0849	SD of Logged Detects	1.217

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.555	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.321	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.257	KM Standard Error of Mean	0.575
KM SD	2.531	95% KM (BCA) UCL	2.34
95% KM (t) UCL	2.248	95% KM (Percentile Bootstrap) UCL	2.283
95% KM (z) UCL	2.202	95% KM Bootstrap t UCL	4.149
90% KM Chebyshev UCL	2.982	95% KM Chebyshev UCL	3.763
97.5% KM Chebyshev UCL	4.848	99% KM Chebyshev UCL	6.978

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.603	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.768	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.197	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.245	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.798	k star (bias corrected MLE)	0.665
Theta hat (MLE)	2.42	Theta star (bias corrected MLE)	2.904
nu hat (MLE)	20.76	nu star (bias corrected)	17.3
Mean (detects)	1.932		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.2
Maximum	12	Median	0.32
SD	2.619	CV	2.182
k hat (MLE)	0.34	k star (bias corrected MLE)	0.323
Theta hat (MLE)	3.533	Theta star (bias corrected MLE)	3.716
nu hat (MLE)	14.27	nu star (bias corrected)	13.56
Adjusted Level of Significance (β)	0.0383		
Approximate Chi Square Value (13.56, α)	6.273	Adjusted Chi Square Value (13.56, β)	5.894
95% Gamma Approximate UCL (use when n>=50)	2.594	95% Gamma Adjusted UCL (use when n<50)	2.761

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Trichloroethene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.257	SD (KM)	2.531
Variance (KM)	6.405	SE of Mean (KM)	0.575
k hat (KM)	0.247	k star (KM)	0.243
nu hat (KM)	10.35	nu star (KM)	10.21
theta hat (KM)	5.097	theta star (KM)	5.17
80% gamma percentile (KM)	1.806	90% gamma percentile (KM)	3.779
95% gamma percentile (KM)	6.133	99% gamma percentile (KM)	12.43

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (10.21, α)	4.072	Adjusted Chi Square Value (10.21, β)	3.778
95% Gamma Approximate KM-UCL (use when n>=50)	3.15	95% Gamma Adjusted KM-UCL (use when n<50)	3.395

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.968	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.866	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.141	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.234	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.237	Mean in Log Scale	-1.007
SD in Original Scale	2.602	SD in Log Scale	1.606
95% t UCL (assumes normality of ROS data)	2.217	95% Percentile Bootstrap UCL	2.243
95% BCA Bootstrap UCL	2.716	95% Bootstrap t UCL	4.025
95% H-UCL (Log ROS)	4.634		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.797	KM Geo Mean	0.451
KM SD (logged)	1.322	95% Critical H Value (KM-Log)	3.032
KM Standard Error of Mean (logged)	0.311	95% H-UCL (KM -Log)	2.647
KM SD (logged)	1.322	95% Critical H Value (KM-Log)	3.032
KM Standard Error of Mean (logged)	0.311		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.253	Mean in Log Scale	-0.831
SD in Original Scale	2.595	SD in Log Scale	1.403
95% t UCL (Assumes normality)	2.229	95% H-Stat UCL	3.139

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	3.395

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	5	Number of Distinct Observations	4
		Number of Missing Observations	10
Number of Detects	1	Number of Non-Detects	4
Number of Distinct Detects	1	Number of Distinct Non-Detects	3

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Benzo(a)anthracene was not processed!

Benzo(a)pyrene

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	10
Number of Detects	1	Number of Non-Detects	4
Number of Distinct Detects	1	Number of Distinct Non-Detects	4

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Benzo(a)pyrene was not processed!

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	10
Number of Detects	1	Number of Non-Detects	4
Number of Distinct Detects	1	Number of Distinct Non-Detects	4

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Benzo(b)fluoranthene was not processed!

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	10
Number of Detects	1	Number of Non-Detects	4
Number of Distinct Detects	1	Number of Distinct Non-Detects	4

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Indeno(1,2,3-cd)pyrene was not processed!

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	3
Minimum	55	Mean	21314
Maximum	170000	Median	3300
SD	52423	Std. Error of Mean	12356
Coefficient of Variation	2.46	Skewness	2.688

Normal GOF Test

Shapiro Wilk Test Statistic	0.432	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.444	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	42809	95% Adjusted-CLT UCL (Chen-1995)	50002
		95% Modified-t UCL (Johnson-1978)	44113

Gamma GOF Test

A-D Test Statistic	1.578	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.84	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.293	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.22	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.311	k star (bias corrected MLE)	0.296
Theta hat (MLE)	68580	Theta star (bias corrected MLE)	72000
nu hat (MLE)	11.19	nu star (bias corrected)	10.66
MLE Mean (bias corrected)	21314	MLE Sd (bias corrected)	39174
		Approximate Chi Square Value (0.05)	4.356
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	3.976

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	52139	95% Adjusted Gamma UCL (use when n<50)	57126

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.951	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.138	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.202	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.007	Mean of logged Data	7.761
Maximum of Logged Data	12.04	SD of logged Data	2.193

Assuming Lognormal Distribution

95% H-UCL	310381	90% Chebyshev (MVUE) UCL	52552
95% Chebyshev (MVUE) UCL	68044	97.5% Chebyshev (MVUE) UCL	89547
99% Chebyshev (MVUE) UCL	131784		

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	41638	95% Jackknife UCL	42809
95% Standard Bootstrap UCL	41191	95% Bootstrap-t UCL	285873
95% Hall's Bootstrap UCL	186440	95% Percentile Bootstrap UCL	40536
95% BCA Bootstrap UCL	48903		
90% Chebyshev(Mean, Sd) UCL	58382	95% Chebyshev(Mean, Sd) UCL	75173
97.5% Chebyshev(Mean, Sd) UCL	98478	99% Chebyshev(Mean, Sd) UCL	144256

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL 144256

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony

General Statistics

Total Number of Observations	18	Number of Distinct Observations	7
		Number of Missing Observations	3
Number of Detects	6	Number of Non-Detects	12
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	0.65	Minimum Non-Detect	0.57
Maximum Detect	5.6	Maximum Non-Detect	0.57
Variance Detects	3.989	Percent Non-Detects	66.67%
Mean Detects	2.327	SD Detects	1.997
Median Detects	1.55	CV Detects	0.858
Skewness Detects	1.084	Kurtosis Detects	-0.23
Mean of Logged Detects	0.527	SD of Logged Detects	0.88

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.271	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.156	KM Standard Error of Mean	0.346
KM SD	1.339	95% KM (BCA) UCL	1.742
95% KM (t) UCL	1.757	95% KM (Percentile Bootstrap) UCL	1.692
95% KM (z) UCL	1.724	95% KM Bootstrap t UCL	2.729
90% KM Chebyshev UCL	2.193	95% KM Chebyshev UCL	2.663
97.5% KM Chebyshev UCL	3.315	99% KM Chebyshev UCL	4.596

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.342	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.706	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.191	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.337	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.722	k star (bias corrected MLE)	0.972
Theta hat (MLE)	1.351	Theta star (bias corrected MLE)	2.394
nu hat (MLE)	20.66	nu star (bias corrected)	11.66
Mean (detects)	2.327		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.782
Maximum	5.6	Median	0.01
SD	1.561	CV	1.995
k hat (MLE)	0.266	k star (bias corrected MLE)	0.258
Theta hat (MLE)	2.946	Theta star (bias corrected MLE)	3.028
nu hat (MLE)	9.56	nu star (bias corrected)	9.3
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (9.30, α)	3.509	Adjusted Chi Square Value (9.30, β)	3.175
95% Gamma Approximate UCL (use when n>=50)	2.073	95% Gamma Adjusted UCL (use when n<50)	2.291

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Antimony (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.156	SD (KM)	1.339
Variance (KM)	1.794	SE of Mean (KM)	0.346
k hat (KM)	0.744	k star (KM)	0.657
nu hat (KM)	26.8	nu star (KM)	23.66
theta hat (KM)	1.552	theta star (KM)	1.758
80% gamma percentile (KM)	1.903	90% gamma percentile (KM)	2.943
95% gamma percentile (KM)	4.023	99% gamma percentile (KM)	6.615

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (23.66, α)	13.59	Adjusted Chi Square Value (23.66, β)	12.86
95% Gamma Approximate KM-UCL (use when n>=50)	2.012	95% Gamma Adjusted KM-UCL (use when n<50)	2.126

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.172	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.851	Mean in Log Scale	-1.661
SD in Original Scale	1.528	SD in Log Scale	1.948
95% t UCL (assumes normality of ROS data)	1.477	95% Percentile Bootstrap UCL	1.46
95% BCA Bootstrap UCL	1.692	95% Bootstrap t UCL	2.571
95% H-UCL (Log ROS)	9.299		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.199	KM Geo Mean	0.819
KM SD (logged)	0.692	95% Critical H Value (KM-Log)	2.228
KM Standard Error of Mean (logged)	0.179	95% H-UCL (KM -Log)	1.513
KM SD (logged)	0.692	95% Critical H Value (KM-Log)	2.228
KM Standard Error of Mean (logged)	0.179		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.966	Mean in Log Scale	-0.661
SD in Original Scale	1.468	SD in Log Scale	0.987
95% t UCL (Assumes normality)	1.567	95% H-Stat UCL	1.574

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	1.757

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	18	Number of Distinct Observations	16
		Number of Missing Observations	3
Number of Detects	14	Number of Non-Detects	4
Number of Distinct Detects	14	Number of Distinct Non-Detects	2
Minimum Detect	1.025	Minimum Non-Detect	0.75
Maximum Detect	360	Maximum Non-Detect	2.9
Variance Detects	10971	Percent Non-Detects	22.22%
Mean Detects	48.93	SD Detects	104.7
Median Detects	7.9	CV Detects	2.141
Skewness Detects	2.61	Kurtosis Detects	6.402
Mean of Logged Detects	2.29	SD of Logged Detects	1.745

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.516	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.405	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	38.26	KM Standard Error of Mean	22.31
KM SD	91.23	95% KM (BCA) UCL	79.61
95% KM (t) UCL	77.07	95% KM (Percentile Bootstrap) UCL	77.99
95% KM (z) UCL	74.96	95% KM Bootstrap t UCL	345.3
90% KM Chebyshev UCL	105.2	95% KM Chebyshev UCL	135.5
97.5% KM Chebyshev UCL	177.6	99% KM Chebyshev UCL	260.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.355	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.811	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.298	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.244	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.41	k star (bias corrected MLE)	0.369
Theta hat (MLE)	119.5	Theta star (bias corrected MLE)	132.5
nu hat (MLE)	11.47	nu star (bias corrected)	10.34
Mean (detects)	48.93		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	38.06
Maximum	360	Median	5.6
SD	93.96	CV	2.469
k hat (MLE)	0.247	k star (bias corrected MLE)	0.243
Theta hat (MLE)	154.1	Theta star (bias corrected MLE)	156.7
nu hat (MLE)	8.891	nu star (bias corrected)	8.742
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (8.74, α)	3.172	Adjusted Chi Square Value (8.74, β)	2.858
95% Gamma Approximate UCL (use when n>=50)	104.9	95% Gamma Adjusted UCL (use when n<50)	116.4

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	38.26	SD (KM)	91.23
Variance (KM)	8322	SE of Mean (KM)	22.31
k hat (KM)	0.176	k star (KM)	0.184
nu hat (KM)	6.331	nu star (KM)	6.609
theta hat (KM)	217.5	theta star (KM)	208.4
80% gamma percentile (KM)	48.04	90% gamma percentile (KM)	115.5
95% gamma percentile (KM)	201.4	99% gamma percentile (KM)	441.5

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.61, α)	1.958	Adjusted Chi Square Value (6.61, β)	1.725
95% Gamma Approximate KM-UCL (use when n>=50)	129.1	95% Gamma Adjusted KM-UCL (use when n<50)	146.5

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	38.13	Mean in Log Scale	1.461
SD in Original Scale	93.93	SD in Log Scale	2.242
95% t UCL (assumes normality of ROS data)	76.64	95% Percentile Bootstrap UCL	77.66
95% BCA Bootstrap UCL	97.12	95% Bootstrap t UCL	356.9
95% H-UCL (Log ROS)	705.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.741	KM Geo Mean	5.703
KM SD (logged)	1.809	95% Critical H Value (KM-Log)	3.972
KM Standard Error of Mean (logged)	0.444	95% H-UCL (KM -Log)	167.4
KM SD (logged)	1.809	95% Critical H Value (KM-Log)	3.972
KM Standard Error of Mean (logged)	0.444		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	38.2	Mean in Log Scale	1.638
SD in Original Scale	93.9	SD in Log Scale	1.996
95% t UCL (Assumes normality)	76.7	95% H-Stat UCL	302.8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	177.6	99% KM (Chebyshev) UCL	260.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium

General Statistics

Total Number of Observations	18	Number of Distinct Observations	15
		Number of Missing Observations	3
Minimum	110	Mean	425.6
Maximum	2400	Median	215
SD	636.9	Std. Error of Mean	150.1
Coefficient of Variation	1.497	Skewness	2.74

Normal GOF Test

Shapiro Wilk Test Statistic	0.485	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.43	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	686.7	95% Adjusted-CLT UCL (Chen-1995)	776
		95% Modified-t UCL (Johnson-1978)	702.8

Gamma GOF Test

A-D Test Statistic	2.787	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.764	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.331	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.209	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	1.142	k star (bias corrected MLE)	0.989
Theta hat (MLE)	372.6	Theta star (bias corrected MLE)	430.4
nu hat (MLE)	41.11	nu star (bias corrected)	35.59
MLE Mean (bias corrected)	425.6	MLE Sd (bias corrected)	428
		Approximate Chi Square Value (0.05)	22.94
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	21.97

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	660.2	95% Adjusted Gamma UCL (use when n<50)	689.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.749	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.257	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.202	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.7	Mean of logged Data	5.555
Maximum of Logged Data	7.783	SD of logged Data	0.834

Assuming Lognormal Distribution

95% H-UCL	596.2	90% Chebyshev (MVUE) UCL	585.8
95% Chebyshev (MVUE) UCL	689.3	97.5% Chebyshev (MVUE) UCL	832.9
99% Chebyshev (MVUE) UCL	1115		

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Barium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	672.5	95% Jackknife UCL	686.7
95% Standard Bootstrap UCL	666	95% Bootstrap-t UCL	2458
95% Hall's Bootstrap UCL	2257	95% Percentile Bootstrap UCL	681.7
95% BCA Bootstrap UCL	787.2		
90% Chebyshev(Mean, Sd) UCL	875.9	95% Chebyshev(Mean, Sd) UCL	1080
97.5% Chebyshev(Mean, Sd) UCL	1363	99% Chebyshev(Mean, Sd) UCL	1919

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL 1080

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Beryllium

General Statistics

Total Number of Observations	18	Number of Distinct Observations	10
		Number of Missing Observations	3
Number of Detects	9	Number of Non-Detects	9
Number of Distinct Detects	8	Number of Distinct Non-Detects	2
Minimum Detect	0.32	Minimum Non-Detect	0.31
Maximum Detect	12	Maximum Non-Detect	0.52
Variance Detects	19.33	Percent Non-Detects	50%
Mean Detects	2.656	SD Detects	4.397
Median Detects	0.6	CV Detects	1.656
Skewness Detects	1.782	Kurtosis Detects	1.845
Mean of Logged Detects	-0.099	SD of Logged Detects	1.41

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.602	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.44	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1.483	KM Standard Error of Mean	0.789
KM SD	3.157	95% KM (BCA) UCL	3.04
95% KM (t) UCL	2.856	95% KM (Percentile Bootstrap) UCL	2.781
95% KM (z) UCL	2.781	95% KM Bootstrap t UCL	26.72
90% KM Chebyshev UCL	3.851	95% KM Chebyshev UCL	4.924
97.5% KM Chebyshev UCL	6.412	99% KM Chebyshev UCL	9.336

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.477	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.765	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.391	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.293	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.578	k star (bias corrected MLE)	0.459
Theta hat (MLE)	4.597	Theta star (bias corrected MLE)	5.783
nu hat (MLE)	10.4	nu star (bias corrected)	8.266
Mean (detects)	2.656		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.333
Maximum	12	Median	0.165
SD	3.309	CV	2.483
k hat (MLE)	0.266	k star (bias corrected MLE)	0.259
Theta hat (MLE)	5.003	Theta star (bias corrected MLE)	5.146
nu hat (MLE)	9.589	nu star (bias corrected)	9.324
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (9.32, α)	3.524	Adjusted Chi Square Value (9.32, β)	3.189
95% Gamma Approximate UCL (use when n>=50)	3.526	95% Gamma Adjusted UCL (use when n<50)	3.897

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Beryllium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1.483	SD (KM)	3.157
Variance (KM)	9.967	SE of Mean (KM)	0.789
k hat (KM)	0.221	k star (KM)	0.221
nu hat (KM)	7.947	nu star (KM)	7.956
theta hat (KM)	6.719	theta star (KM)	6.712
80% gamma percentile (KM)	2.051	90% gamma percentile (KM)	4.48
95% gamma percentile (KM)	7.44	99% gamma percentile (KM)	15.46

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.96, α)	2.709	Adjusted Chi Square Value (7.96, β)	2.424
95% Gamma Approximate KM-UCL (use when n>=50)	4.355	95% Gamma Adjusted KM-UCL (use when n<50)	4.868

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.732	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.309	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.349	Mean in Log Scale	-1.841
SD in Original Scale	3.302	SD in Log Scale	2.176
95% t UCL (assumes normality of ROS data)	2.703	95% Percentile Bootstrap UCL	2.663
95% BCA Bootstrap UCL	3.221	95% Bootstrap t UCL	16.18
95% H-UCL (Log ROS)	19.55		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.634	KM Geo Mean	0.531
KM SD (logged)	1.081	95% Critical H Value (KM-Log)	2.758
KM Standard Error of Mean (logged)	0.27	95% H-UCL (KM -Log)	1.963
KM SD (logged)	1.081	95% Critical H Value (KM-Log)	2.758
KM Standard Error of Mean (logged)	0.27		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1.411	Mean in Log Scale	-0.953
SD in Original Scale	3.277	SD in Log Scale	1.312
95% t UCL (Assumes normality)	2.755	95% H-Stat UCL	2.462

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	4.924

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	18	Number of Distinct Observations	7
		Number of Missing Observations	3
Number of Detects	7	Number of Non-Detects	11
Number of Distinct Detects	7	Number of Distinct Non-Detects	1
Minimum Detect	0.21	Minimum Non-Detect	0.21
Maximum Detect	4.2	Maximum Non-Detect	0.21
Variance Detects	2.852	Percent Non-Detects	61.11%
Mean Detects	1.461	SD Detects	1.689
Median Detects	0.68	CV Detects	1.156
Skewness Detects	1.206	Kurtosis Detects	-0.625
Mean of Logged Detects	-0.217	SD of Logged Detects	1.172

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.735	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.803	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.358	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.304	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.697	KM Standard Error of Mean	0.293
KM SD	1.15	95% KM (BCA) UCL	1.184
95% KM (t) UCL	1.206	95% KM (Percentile Bootstrap) UCL	1.189
95% KM (z) UCL	1.178	95% KM Bootstrap t UCL	3.266
90% KM Chebyshev UCL	1.575	95% KM Chebyshev UCL	1.973
97.5% KM Chebyshev UCL	2.525	99% KM Chebyshev UCL	3.61

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.595	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.728	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.272	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.32	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.971	k star (bias corrected MLE)	0.65
Theta hat (MLE)	1.504	Theta star (bias corrected MLE)	2.247
nu hat (MLE)	13.6	nu star (bias corrected)	9.105
Mean (detects)	1.461		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.574
Maximum	4.2	Median	0.01
SD	1.24	CV	2.158
k hat (MLE)	0.295	k star (bias corrected MLE)	0.283
Theta hat (MLE)	1.947	Theta star (bias corrected MLE)	2.031
nu hat (MLE)	10.62	nu star (bias corrected)	10.18
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (10.18, α)	4.056	Adjusted Chi Square Value (10.18, β)	3.692
95% Gamma Approximate UCL (use when n>=50)	1.442	95% Gamma Adjusted UCL (use when n<50)	1.584

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.697	SD (KM)	1.15
Variance (KM)	1.323	SE of Mean (KM)	0.293
k hat (KM)	0.367	k star (KM)	0.343
nu hat (KM)	13.21	nu star (KM)	12.34
theta hat (KM)	1.899	theta star (KM)	2.032
80% gamma percentile (KM)	1.099	90% gamma percentile (KM)	2.018
95% gamma percentile (KM)	3.051	99% gamma percentile (KM)	5.691

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.34, α)	5.453	Adjusted Chi Square Value (12.34, β)	5.018
95% Gamma Approximate KM-UCL (use when n>=50)	1.577	95% Gamma Adjusted KM-UCL (use when n<50)	1.713

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.803	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.2	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.304	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.588	Mean in Log Scale	-2.631
SD in Original Scale	1.233	SD in Log Scale	2.38
95% t UCL (assumes normality of ROS data)	1.094	95% Percentile Bootstrap UCL	1.099
95% BCA Bootstrap UCL	1.261	95% Bootstrap t UCL	3.039
95% H-UCL (Log ROS)	22.06		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.038	KM Geo Mean	0.354
KM SD (logged)	0.942	95% Critical H Value (KM-Log)	2.555
KM Standard Error of Mean (logged)	0.24	95% H-UCL (KM -Log)	0.989
KM SD (logged)	0.942	95% Critical H Value (KM-Log)	2.555
KM Standard Error of Mean (logged)	0.24		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.633	Mean in Log Scale	-1.462
SD in Original Scale	1.212	SD in Log Scale	1.237
95% t UCL (Assumes normality)	1.13	95% H-Stat UCL	1.224

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	1.713

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium

General Statistics

Total Number of Observations	18	Number of Distinct Observations	12
		Number of Missing Observations	3
Number of Detects	12	Number of Non-Detects	6
Number of Distinct Detects	10	Number of Distinct Non-Detects	2
Minimum Detect	1.6	Minimum Non-Detect	0.98
Maximum Detect	495	Maximum Non-Detect	30
Variance Detects	23385	Percent Non-Detects	33.33%
Mean Detects	80.87	SD Detects	152.9
Median Detects	18	CV Detects	1.891
Skewness Detects	2.356	Kurtosis Detects	5.053
Mean of Logged Detects	2.961	SD of Logged Detects	1.799

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.573	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.377	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	54.58	KM Standard Error of Mean	30.83
KM SD	125.2	95% KM (BCA) UCL	109.1
95% KM (t) UCL	108.2	95% KM (Percentile Bootstrap) UCL	107.6
95% KM (z) UCL	105.3	95% KM Bootstrap t UCL	394.5
90% KM Chebyshev UCL	147.1	95% KM Chebyshev UCL	189
97.5% KM Chebyshev UCL	247.1	99% KM Chebyshev UCL	361.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.873	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.795	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.269	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.26	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.451	k star (bias corrected MLE)	0.394
Theta hat (MLE)	179.4	Theta star (bias corrected MLE)	205.4
nu hat (MLE)	10.82	nu star (bias corrected)	9.448
Mean (detects)	80.87		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	53.91
Maximum	495	Median	7.1
SD	129.1	CV	2.395
k hat (MLE)	0.206	k star (bias corrected MLE)	0.209
Theta hat (MLE)	261.3	Theta star (bias corrected MLE)	258
nu hat (MLE)	7.429	nu star (bias corrected)	7.524
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (7.52, α)	2.463	Adjusted Chi Square Value (7.52, β)	2.194
95% Gamma Approximate UCL (use when n>=50)	164.7	95% Gamma Adjusted UCL (use when n<50)	184.9

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	54.58	SD (KM)	125.2
Variance (KM)	15678	SE of Mean (KM)	30.83
k hat (KM)	0.19	k star (KM)	0.195
nu hat (KM)	6.841	nu star (KM)	7.034
theta hat (KM)	287.2	theta star (KM)	279.3
80% gamma percentile (KM)	71.03	90% gamma percentile (KM)	165
95% gamma percentile (KM)	282.9	99% gamma percentile (KM)	608.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.03, α)	2.189	Adjusted Chi Square Value (7.03, β)	1.939
95% Gamma Approximate KM-UCL (use when n>=50)	175.4	95% Gamma Adjusted KM-UCL (use when n<50)	198

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.859	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.243	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	54.16	Mean in Log Scale	1.684
SD in Original Scale	129	SD in Log Scale	2.452
95% t UCL (assumes normality of ROS data)	107.1	95% Percentile Bootstrap UCL	106.3
95% BCA Bootstrap UCL	133	95% Bootstrap t UCL	411.6
95% H-UCL (Log ROS)	2319		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.036	KM Geo Mean	7.661
KM SD (logged)	1.962	95% Critical H Value (KM-Log)	4.245
KM Standard Error of Mean (logged)	0.489	95% H-UCL (KM -Log)	395.5
KM SD (logged)	1.962	95% Critical H Value (KM-Log)	4.245
KM Standard Error of Mean (logged)	0.489		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	54.88	Mean in Log Scale	1.926
SD in Original Scale	128.7	SD in Log Scale	2.221
95% t UCL (Assumes normality)	107.7	95% H-Stat UCL	1027

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	247.1	99% KM (Chebyshev) UCL	361.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	18	Number of Distinct Observations	17
		Number of Missing Observations	3
Number of Detects	17	Number of Non-Detects	1
Number of Distinct Detects	16	Number of Distinct Non-Detects	1
Minimum Detect	0.2	Minimum Non-Detect	2.8
Maximum Detect	190	Maximum Non-Detect	2.8
Variance Detects	2722	Percent Non-Detects	5.556%
Mean Detects	20.45	SD Detects	52.17
Median Detects	2.4	CV Detects	2.551
Skewness Detects	2.879	Kurtosis Detects	7.73
Mean of Logged Detects	1.009	SD of Logged Detects	1.829

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.432	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.892	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.482	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.207	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	19.39	KM Standard Error of Mean	12
KM SD	49.38	95% KM (BCA) UCL	45.45
95% KM (t) UCL	40.26	95% KM (Percentile Bootstrap) UCL	40.43
95% KM (z) UCL	39.12	95% KM Bootstrap t UCL	475.5
90% KM Chebyshev UCL	55.38	95% KM Chebyshev UCL	71.68
97.5% KM Chebyshev UCL	94.31	99% KM Chebyshev UCL	138.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.281	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.834	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.35	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.226	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.337	k star (bias corrected MLE)	0.317
Theta hat (MLE)	60.71	Theta star (bias corrected MLE)	64.59
nu hat (MLE)	11.45	nu star (bias corrected)	10.76
Mean (detects)	20.45		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	19.32
Maximum	190	Median	2.35
SD	50.84	CV	2.632
k hat (MLE)	0.304	k star (bias corrected MLE)	0.29
Theta hat (MLE)	63.54	Theta star (bias corrected MLE)	66.52
nu hat (MLE)	10.94	nu star (bias corrected)	10.45
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (10.45, α)	4.227	Adjusted Chi Square Value (10.45, β)	3.853
95% Gamma Approximate UCL (use when n>=50)	47.77	95% Gamma Adjusted UCL (use when n<50)	52.4

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	19.39	SD (KM)	49.38
Variance (KM)	2439	SE of Mean (KM)	12
k hat (KM)	0.154	k star (KM)	0.165
nu hat (KM)	5.547	nu star (KM)	5.956
theta hat (KM)	125.8	theta star (KM)	117.2
80% gamma percentile (KM)	22.74	90% gamma percentile (KM)	58.12
95% gamma percentile (KM)	104.6	99% gamma percentile (KM)	236.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.96, α)	1.618	Adjusted Chi Square Value (5.96, β)	1.411
95% Gamma Approximate KM-UCL (use when n>=50)	71.38	95% Gamma Adjusted KM-UCL (use when n<50)	81.81

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.892	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.179	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.207	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	19.37	Mean in Log Scale	0.952
SD in Original Scale	50.82	SD in Log Scale	1.791
95% t UCL (assumes normality of ROS data)	40.21	95% Percentile Bootstrap UCL	40.58
95% BCA Bootstrap UCL	50.46	95% Bootstrap t UCL	459.5
95% H-UCL (Log ROS)	71.31		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.949	KM Geo Mean	2.584
KM SD (logged)	1.754	95% Critical H Value (KM-Log)	3.875
KM Standard Error of Mean (logged)	0.43	95% H-UCL (KM -Log)	62.61
KM SD (logged)	1.754	95% Critical H Value (KM-Log)	3.875
KM Standard Error of Mean (logged)	0.43		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	19.39	Mean in Log Scale	0.972
SD in Original Scale	50.81	SD in Log Scale	1.782
95% t UCL (Assumes normality)	40.23	95% H-Stat UCL	70.38

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	94.31	99% KM (Chebyshev) UCL	138.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	18	Number of Distinct Observations	17
		Number of Missing Observations	3
Number of Detects	16	Number of Non-Detects	2
Number of Distinct Detects	15	Number of Distinct Non-Detects	2
Minimum Detect	1.9	Minimum Non-Detect	1.7
Maximum Detect	420	Maximum Non-Detect	52
Variance Detects	22904	Percent Non-Detects	11.11%
Mean Detects	81.37	SD Detects	151.3
Median Detects	10.5	CV Detects	1.86
Skewness Detects	1.796	Kurtosis Detects	1.541
Mean of Logged Detects	2.641	SD of Logged Detects	1.913

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.564	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.395	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	73.03	KM Standard Error of Mean	34.14
KM SD	140.2	95% KM (BCA) UCL	125.8
95% KM (t) UCL	132.4	95% KM (Percentile Bootstrap) UCL	133.2
95% KM (z) UCL	129.2	95% KM Bootstrap t UCL	159.8
90% KM Chebyshev UCL	175.4	95% KM Chebyshev UCL	221.8
97.5% KM Chebyshev UCL	286.2	99% KM Chebyshev UCL	412.7

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.617	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.822	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.265	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.231	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.378	k star (bias corrected MLE)	0.349
Theta hat (MLE)	215.3	Theta star (bias corrected MLE)	233.4
nu hat (MLE)	12.09	nu star (bias corrected)	11.16
Mean (detects)	81.37		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	72.33
Maximum	420	Median	8
SD	144.6	CV	1.999
k hat (MLE)	0.284	k star (bias corrected MLE)	0.274
Theta hat (MLE)	254.2	Theta star (bias corrected MLE)	263.9
nu hat (MLE)	10.24	nu star (bias corrected)	9.868
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (9.87, α)	3.859	Adjusted Chi Square Value (9.87, β)	3.505
95% Gamma Approximate UCL (use when n>=50)	184.9	95% Gamma Adjusted UCL (use when n<50)	203.6

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	73.03	SD (KM)	140.2
Variance (KM)	19655	SE of Mean (KM)	34.14
k hat (KM)	0.271	k star (KM)	0.263
nu hat (KM)	9.768	nu star (KM)	9.473
theta hat (KM)	269.1	theta star (KM)	277.5
80% gamma percentile (KM)	107.9	90% gamma percentile (KM)	218.3
95% gamma percentile (KM)	348.1	99% gamma percentile (KM)	691

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.47, α)	3.615	Adjusted Chi Square Value (9.47, β)	3.275
95% Gamma Approximate KM-UCL (use when n>=50)	191.4	95% Gamma Adjusted KM-UCL (use when n<50)	211.2

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	72.7	Mean in Log Scale	2.353
SD in Original Scale	144.4	SD in Log Scale	2.081
95% t UCL (assumes normality of ROS data)	131.9	95% Percentile Bootstrap UCL	130.7
95% BCA Bootstrap UCL	149.3	95% Bootstrap t UCL	161.1
95% H-UCL (Log ROS)	869.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.476	KM Geo Mean	11.9
KM SD (logged)	1.837	95% Critical H Value (KM-Log)	4.021
KM Standard Error of Mean (logged)	0.452	95% H-UCL (KM -Log)	386.1
KM SD (logged)	1.837	95% Critical H Value (KM-Log)	4.021
KM Standard Error of Mean (logged)	0.452		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	73.82	Mean in Log Scale	2.52
SD in Original Scale	143.9	SD in Log Scale	1.923
95% t UCL (Assumes normality)	132.8	95% H-Stat UCL	553.4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	286.2	99% KM (Chebyshev) UCL	412.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	18	Number of Distinct Observations	17
		Number of Missing Observations	3
Number of Detects	16	Number of Non-Detects	2
Number of Distinct Detects	15	Number of Distinct Non-Detects	2
Minimum Detect	62	Minimum Non-Detect	47
Maximum Detect	500000	Maximum Non-Detect	7300
Variance Detects	2.427E+10	Percent Non-Detects	11.11%
Mean Detects	68433	SD Detects	155776
Median Detects	11200	CV Detects	2.276
Skewness Detects	2.515	Kurtosis Detects	5.083
Mean of Logged Detects	9.052	SD of Logged Detects	2.269

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.472	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.442	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	60933	KM Standard Error of Mean	35000
KM SD	143778	95% KM (BCA) UCL	130887
95% KM (t) UCL	121820	95% KM (Percentile Bootstrap) UCL	120414
95% KM (z) UCL	118504	95% KM Bootstrap t UCL	717141
90% KM Chebyshev UCL	165934	95% KM Chebyshev UCL	213496
97.5% KM Chebyshev UCL	279510	99% KM Chebyshev UCL	409182

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.165	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.832	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.263	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.232	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.327	k star (bias corrected MLE)	0.307
Theta hat (MLE)	209496	Theta star (bias corrected MLE)	222855
nu hat (MLE)	10.45	nu star (bias corrected)	9.826
Mean (detects)	68433		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	60830
Maximum	500000	Median	6200
SD	147990	CV	2.433
k hat (MLE)	0.21	k star (bias corrected MLE)	0.212
Theta hat (MLE)	289938	Theta star (bias corrected MLE)	287106
nu hat (MLE)	7.553	nu star (bias corrected)	7.627
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (7.63, α)	2.521	Adjusted Chi Square Value (7.63, β)	2.248
95% Gamma Approximate UCL (use when n>=50)	184029	95% Gamma Adjusted UCL (use when n<50)	206383

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	60933	SD (KM)	143778
Variance (KM)	2.067E+10	SE of Mean (KM)	35000
k hat (KM)	0.18	k star (KM)	0.187
nu hat (KM)	6.466	nu star (KM)	6.722
theta hat (KM)	339257	theta star (KM)	326352
80% gamma percentile (KM)	77287	90% gamma percentile (KM)	184045
95% gamma percentile (KM)	319490	99% gamma percentile (KM)	696705

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.72, α)	2.019	Adjusted Chi Square Value (6.72, β)	1.781
95% Gamma Approximate KM-UCL (use when n>=50)	202850	95% Gamma Adjusted KM-UCL (use when n<50)	229910

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.124	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	60884	Mean in Log Scale	8.631
SD in Original Scale	147967	SD in Log Scale	2.518
95% t UCL (assumes normality of ROS data)	121555	95% Percentile Bootstrap UCL	117189
95% BCA Bootstrap UCL	141062	95% Bootstrap t UCL	720285
95% H-UCL (Log ROS)	3330318		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	8.632	KM Geo Mean	5609
KM SD (logged)	2.465	95% Critical H Value (KM-Log)	5.171
KM Standard Error of Mean (logged)	0.609	95% H-UCL (KM -Log)	2579070
KM SD (logged)	2.465	95% Critical H Value (KM-Log)	5.171
KM Standard Error of Mean (logged)	0.609		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	61034	Mean in Log Scale	8.677
SD in Original Scale	147904	SD in Log Scale	2.546
95% t UCL (Assumes normality)	121679	95% H-Stat UCL	4011046

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

99% KM (Chebyshev) UCL	409182

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	18	Number of Distinct Observations	15
		Number of Missing Observations	3
Minimum	0.45	Mean	41.8
Maximum	325	Median	4.75
SD	97.71	Std. Error of Mean	23.03
Coefficient of Variation	2.337	Skewness	2.641

Normal GOF Test

Shapiro Wilk Test Statistic	0.467	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.406	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.202	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	81.87	95% Adjusted-CLT UCL (Chen-1995)	95
		95% Modified-t UCL (Johnson-1978)	84.26

Gamma GOF Test

A-D Test Statistic	1.619	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.835	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.255	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.22	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.332	k star (bias corrected MLE)	0.314
Theta hat (MLE)	126	Theta star (bias corrected MLE)	133.3
nu hat (MLE)	11.94	nu star (bias corrected)	11.29
MLE Mean (bias corrected)	41.8	MLE Sd (bias corrected)	74.66
		Approximate Chi Square Value (0.05)	4.761
Adjusted Level of Significance	0.0357	Adjusted Chi Square Value	4.36

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	99.1	95% Adjusted Gamma UCL (use when n<50)	108.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.897	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.11	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.202	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-0.799	Mean of logged Data	1.688
Maximum of Logged Data	5.784	SD of logged Data	2.02

Assuming Lognormal Distribution

95% H-UCL	350.5	90% Chebyshev (MVUE) UCL	86.19
95% Chebyshev (MVUE) UCL	110.9	97.5% Chebyshev (MVUE) UCL	145.1
99% Chebyshev (MVUE) UCL	212.4		

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	79.68	95% Jackknife UCL	81.87
95% Standard Bootstrap UCL	78.77	95% Bootstrap-t UCL	322.4
95% Hall's Bootstrap UCL	322.7	95% Percentile Bootstrap UCL	79.53
95% BCA Bootstrap UCL	94.91		
90% Chebyshev(Mean, Sd) UCL	110.9	95% Chebyshev(Mean, Sd) UCL	142.2
97.5% Chebyshev(Mean, Sd) UCL	185.6	99% Chebyshev(Mean, Sd) UCL	270.9

Suggested UCL to Use

99% Chebyshev (Mean, Sd) UCL	270.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	18	Number of Distinct Observations	18
		Number of Missing Observations	3
Number of Detects	17	Number of Non-Detects	1
Number of Distinct Detects	17	Number of Distinct Non-Detects	1
Minimum Detect	22	Minimum Non-Detect	220
Maximum Detect	7300	Maximum Non-Detect	220
Variance Detects	5015147	Percent Non-Detects	5.556%
Mean Detects	1379	SD Detects	2239
Median Detects	630	CV Detects	1.624
Skewness Detects	2.372	Kurtosis Detects	4.596
Mean of Logged Detects	6.309	SD of Logged Detects	1.423

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.574	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.892	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.335	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.207	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	1309	KM Standard Error of Mean	517.8
KM SD	2131	95% KM (BCA) UCL	2311
95% KM (t) UCL	2209	95% KM (Percentile Bootstrap) UCL	2146
95% KM (z) UCL	2160	95% KM Bootstrap t UCL	4442
90% KM Chebyshev UCL	2862	95% KM Chebyshev UCL	3566
97.5% KM Chebyshev UCL	4542	99% KM Chebyshev UCL	6461

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.921	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.784	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.201	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.219	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.662	k star (bias corrected MLE)	0.585
Theta hat (MLE)	2082	Theta star (bias corrected MLE)	2359
nu hat (MLE)	22.52	nu star (bias corrected)	19.88
Mean (detects)	1379		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1302
Maximum	7300	Median	540
SD	2197	CV	1.687
k hat (MLE)	0.441	k star (bias corrected MLE)	0.405
Theta hat (MLE)	2953	Theta star (bias corrected MLE)	3219
nu hat (MLE)	15.88	nu star (bias corrected)	14.56
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (14.56, α)	6.96	Adjusted Chi Square Value (14.56, β)	6.46
95% Gamma Approximate UCL (use when n>=50)	2725	95% Gamma Adjusted UCL (use when n<50)	2936

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	1309	SD (KM)	2131
Variance (KM)	4542131	SE of Mean (KM)	517.8
k hat (KM)	0.377	k star (KM)	0.351
nu hat (KM)	13.57	nu star (KM)	12.64
theta hat (KM)	3471	theta star (KM)	3726
80% gamma percentile (KM)	2073	90% gamma percentile (KM)	3777
95% gamma percentile (KM)	5684	99% gamma percentile (KM)	10548

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.64, α)	5.655	Adjusted Chi Square Value (12.64, β)	5.211
95% Gamma Approximate KM-UCL (use when n>=50)	2926	95% Gamma Adjusted KM-UCL (use when n<50)	3175

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.957	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.892	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.11	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.207	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1306	Mean in Log Scale	6.197
SD in Original Scale	2194	SD in Log Scale	1.461
95% t UCL (assumes normality of ROS data)	2206	95% Percentile Bootstrap UCL	2249
95% BCA Bootstrap UCL	2545	95% Bootstrap t UCL	4722
95% H-UCL (Log ROS)	4706		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	6.203	KM Geo Mean	494.4
KM SD (logged)	1.428	95% Critical H Value (KM-Log)	3.313
KM Standard Error of Mean (logged)	0.353	95% H-UCL (KM -Log)	4322
KM SD (logged)	1.428	95% Critical H Value (KM-Log)	3.313
KM Standard Error of Mean (logged)	0.353		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	1308	Mean in Log Scale	6.22
SD in Original Scale	2193	SD in Log Scale	1.432
95% t UCL (Assumes normality)	2208	95% H-Stat UCL	4437

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	3175

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	18	Number of Distinct Observations	3
		Number of Missing Observations	3
Number of Detects	2	Number of Non-Detects	16
Number of Distinct Detects	2	Number of Distinct Non-Detects	1
Minimum Detect	0.31	Minimum Non-Detect	0.13
Maximum Detect	0.35	Maximum Non-Detect	0.13
Variance Detects	8.0000E-4	Percent Non-Detects	88.89%
Mean Detects	0.33	SD Detects	0.0283
Median Detects	0.33	CV Detects	0.0857
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-1.111	SD of Logged Detects	0.0858

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.152	KM Standard Error of Mean	0.0211
KM SD	0.0632	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.189	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.187	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.215	95% KM Chebyshev UCL	0.244
97.5% KM Chebyshev UCL	0.284	99% KM Chebyshev UCL	0.362

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	271.9	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.00121	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	1088	nu star (bias corrected)	N/A
Mean (detects)	0.33		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.152	SD (KM)	0.0632
Variance (KM)	0.004	SE of Mean (KM)	0.0211
k hat (KM)	5.8	k star (KM)	4.87
nu hat (KM)	208.8	nu star (KM)	175.3
theta hat (KM)	0.0262	theta star (KM)	0.0313
80% gamma percentile (KM)	0.205	90% gamma percentile (KM)	0.245
95% gamma percentile (KM)	0.28	99% gamma percentile (KM)	0.356

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0357
Approximate Chi Square Value (175.34, α)	145.7	Adjusted Chi Square Value (175.34, β)	143.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.183	95% Gamma Adjusted KM-UCL (use when n<50)	0.186

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.196	Mean in Log Scale	-1.683
SD in Original Scale	0.0658	SD in Log Scale	0.327
95% t UCL (assumes normality of ROS data)	0.223	95% Percentile Bootstrap UCL	0.221
95% BCA Bootstrap UCL	0.223	95% Bootstrap t UCL	0.227
95% H-UCL (Log ROS)	0.227		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.937	KM Geo Mean	0.144
KM SD (logged)	0.293	95% Critical H Value (KM-Log)	1.848
KM Standard Error of Mean (logged)	0.0976	95% H-UCL (KM -Log)	0.172
KM SD (logged)	0.293	95% Critical H Value (KM-Log)	1.848
KM Standard Error of Mean (logged)	0.0976		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0944	Mean in Log Scale	-2.553
SD in Original Scale	0.086	SD in Log Scale	0.525
95% t UCL (Assumes normality)	0.13	95% H-Stat UCL	0.116

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.189	KM H-UCL	0.172

Warning: One or more Recommended UCL(s) not available!

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	18	Number of Distinct Observations	16
		Number of Missing Observations	3
Number of Detects	14	Number of Non-Detects	4
Number of Distinct Detects	14	Number of Distinct Non-Detects	2
Minimum Detect	1.6	Minimum Non-Detect	1.5
Maximum Detect	470	Maximum Non-Detect	32
Variance Detects	22300	Percent Non-Detects	22.22%
Mean Detects	71.46	SD Detects	149.3
Median Detects	12.5	CV Detects	2.09
Skewness Detects	2.353	Kurtosis Detects	4.362
Mean of Logged Detects	2.758	SD of Logged Detects	1.659

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.506	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.441	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	56.33	KM Standard Error of Mean	31.81
KM SD	130	95% KM (BCA) UCL	109.1
95% KM (t) UCL	111.7	95% KM (Percentile Bootstrap) UCL	110.4
95% KM (z) UCL	108.7	95% KM Bootstrap t UCL	628.1
90% KM Chebyshev UCL	151.8	95% KM Chebyshev UCL	195
97.5% KM Chebyshev UCL	255	99% KM Chebyshev UCL	372.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.561	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.807	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.294	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.244	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.43	k star (bias corrected MLE)	0.386
Theta hat (MLE)	166.1	Theta star (bias corrected MLE)	185.3
nu hat (MLE)	12.05	nu star (bias corrected)	10.8
Mean (detects)	71.46		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	55.58
Maximum	470	Median	8.7
SD	134.1	CV	2.413
k hat (MLE)	0.246	k star (bias corrected MLE)	0.242
Theta hat (MLE)	226.1	Theta star (bias corrected MLE)	229.7
nu hat (MLE)	8.852	nu star (bias corrected)	8.71
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (8.71, α)	3.153	Adjusted Chi Square Value (8.71, β)	2.839
95% Gamma Approximate UCL (use when n>=50)	153.6	95% Gamma Adjusted UCL (use when n<50)	170.5

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	56.33	SD (KM)	130
Variance (KM)	16913	SE of Mean (KM)	31.81
k hat (KM)	0.188	k star (KM)	0.193
nu hat (KM)	6.753	nu star (KM)	6.961
theta hat (KM)	300.3	theta star (KM)	291.3
80% gamma percentile (KM)	72.88	90% gamma percentile (KM)	170.3
95% gamma percentile (KM)	292.8	99% gamma percentile (KM)	631.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.96, α)	2.149	Adjusted Chi Square Value (6.96, β)	1.902
95% Gamma Approximate KM-UCL (use when n>=50)	182.4	95% Gamma Adjusted KM-UCL (use when n<50)	206.1

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.182	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	55.93	Mean in Log Scale	2.08
SD in Original Scale	134	SD in Log Scale	2.034
95% t UCL (assumes normality of ROS data)	110.9	95% Percentile Bootstrap UCL	108.5
95% BCA Bootstrap UCL	127.1	95% Bootstrap t UCL	636.1
95% H-UCL (Log ROS)	549.6		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.308	KM Geo Mean	10.05
KM SD (logged)	1.681	95% Critical H Value (KM-Log)	3.746
KM Standard Error of Mean (logged)	0.416	95% H-UCL (KM -Log)	190.4
KM SD (logged)	1.681	95% Critical H Value (KM-Log)	3.746
KM Standard Error of Mean (logged)	0.416		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	56.59	Mean in Log Scale	2.251
SD in Original Scale	133.7	SD in Log Scale	1.863
95% t UCL (Assumes normality)	111.4	95% H-Stat UCL	338.1

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	255	99% KM (Chebyshev) UCL	372.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Selenium

General Statistics

Total Number of Observations	18	Number of Distinct Observations	12
		Number of Missing Observations	3
Number of Detects	10	Number of Non-Detects	8
Number of Distinct Detects	10	Number of Distinct Non-Detects	2
Minimum Detect	0.95	Minimum Non-Detect	0.89
Maximum Detect	19	Maximum Non-Detect	2.9
Variance Detects	48.15	Percent Non-Detects	44.44%
Mean Detects	7.945	SD Detects	6.939
Median Detects	7.3	CV Detects	0.873
Skewness Detects	0.521	Kurtosis Detects	-1.315
Mean of Logged Detects	1.549	SD of Logged Detects	1.205

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.869	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.208	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	4.817	KM Standard Error of Mean	1.497
KM SD	6.026	95% KM (BCA) UCL	7.027
95% KM (t) UCL	7.422	95% KM (Percentile Bootstrap) UCL	7.232
95% KM (z) UCL	7.28	95% KM Bootstrap t UCL	8.283
90% KM Chebyshev UCL	9.309	95% KM Chebyshev UCL	11.34
97.5% KM Chebyshev UCL	14.17	99% KM Chebyshev UCL	19.71

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.558	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.747	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.206	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.273	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.092	k star (bias corrected MLE)	0.831
Theta hat (MLE)	7.277	Theta star (bias corrected MLE)	9.562
nu hat (MLE)	21.84	nu star (bias corrected)	16.62
Mean (detects)	7.945		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	4.418
Maximum	19	Median	1.025
SD	6.477	CV	1.466
k hat (MLE)	0.264	k star (bias corrected MLE)	0.257
Theta hat (MLE)	16.76	Theta star (bias corrected MLE)	17.21
nu hat (MLE)	9.489	nu star (bias corrected)	9.241
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (9.24, α)	3.473	Adjusted Chi Square Value (9.24, β)	3.141
95% Gamma Approximate UCL (use when n>=50)	11.76	95% Gamma Adjusted UCL (use when n<50)	13

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Selenium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	4.817	SD (KM)	6.026
Variance (KM)	36.31	SE of Mean (KM)	1.497
k hat (KM)	0.639	k star (KM)	0.57
nu hat (KM)	23.01	nu star (KM)	20.51
theta hat (KM)	7.537	theta star (KM)	8.456
80% gamma percentile (KM)	7.939	90% gamma percentile (KM)	12.67
95% gamma percentile (KM)	17.66	99% gamma percentile (KM)	29.78

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (20.51, α)	11.23	Adjusted Chi Square Value (20.51, β)	10.57
95% Gamma Approximate KM-UCL (use when n>=50)	8.8	95% Gamma Adjusted KM-UCL (use when n<50)	9.346

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.859	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.229	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	4.556	Mean in Log Scale	0.228
SD in Original Scale	6.381	SD in Log Scale	1.847
95% t UCL (assumes normality of ROS data)	7.172	95% Percentile Bootstrap UCL	7.065
95% BCA Bootstrap UCL	7.593	95% Bootstrap t UCL	8.184
95% H-UCL (Log ROS)	42.17		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.816	KM Geo Mean	2.26
KM SD (logged)	1.184	95% Critical H Value (KM-Log)	2.916
KM Standard Error of Mean (logged)	0.295	95% H-UCL (KM -Log)	10.53
KM SD (logged)	1.184	95% Critical H Value (KM-Log)	2.916
KM Standard Error of Mean (logged)	0.295		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	4.668	Mean in Log Scale	0.566
SD in Original Scale	6.306	SD in Log Scale	1.456
95% t UCL (Assumes normality)	7.253	95% H-Stat UCL	16.63

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	7.422

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	18	Number of Distinct Observations	9
		Number of Missing Observations	3
Number of Detects	9	Number of Non-Detects	9
Number of Distinct Detects	8	Number of Distinct Non-Detects	1
Minimum Detect	0.22	Minimum Non-Detect	0.2
Maximum Detect	5.2	Maximum Non-Detect	0.2
Variance Detects	4.026	Percent Non-Detects	50%
Mean Detects	1.332	SD Detects	2.006
Median Detects	0.32	CV Detects	1.506
Skewness Detects	1.634	Kurtosis Detects	0.921
Mean of Logged Detects	-0.574	SD of Logged Detects	1.264

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.603	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.409	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.274	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.766	KM Standard Error of Mean	0.363
KM SD	1.453	95% KM (BCA) UCL	1.302
95% KM (t) UCL	1.398	95% KM (Percentile Bootstrap) UCL	1.35
95% KM (z) UCL	1.363	95% KM Bootstrap t UCL	7.658
90% KM Chebyshev UCL	1.855	95% KM Chebyshev UCL	2.349
97.5% KM Chebyshev UCL	3.034	99% KM Chebyshev UCL	4.379

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.481	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.755	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.366	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.29	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.702	k star (bias corrected MLE)	0.542
Theta hat (MLE)	1.899	Theta star (bias corrected MLE)	2.459
nu hat (MLE)	12.63	nu star (bias corrected)	9.753
Mean (detects)	1.332		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.671
Maximum	5.2	Median	0.115
SD	1.535	CV	2.288
k hat (MLE)	0.313	k star (bias corrected MLE)	0.298
Theta hat (MLE)	2.147	Theta star (bias corrected MLE)	2.255
nu hat (MLE)	11.25	nu star (bias corrected)	10.71
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (10.71, α)	4.392	Adjusted Chi Square Value (10.71, β)	4.01
95% Gamma Approximate UCL (use when n>=50)	1.637	95% Gamma Adjusted UCL (use when n<50)	1.793

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.766	SD (KM)	1.453
Variance (KM)	2.11	SE of Mean (KM)	0.363
k hat (KM)	0.278	k star (KM)	0.269
nu hat (KM)	10.01	nu star (KM)	9.679
theta hat (KM)	2.754	theta star (KM)	2.849
80% gamma percentile (KM)	1.14	90% gamma percentile (KM)	2.286
95% gamma percentile (KM)	3.628	99% gamma percentile (KM)	7.163

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (9.68, α)	3.742	Adjusted Chi Square Value (9.68, β)	3.395
95% Gamma Approximate KM-UCL (use when n>=50)	1.982	95% Gamma Adjusted KM-UCL (use when n<50)	2.184

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.725	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.829	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.33	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.274	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.68	Mean in Log Scale	-2.316
SD in Original Scale	1.531	SD in Log Scale	2.144
95% t UCL (assumes normality of ROS data)	1.308	95% Percentile Bootstrap UCL	1.282
95% BCA Bootstrap UCL	1.508	95% Bootstrap t UCL	5.58
95% H-UCL (Log ROS)	10.6		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.092	KM Geo Mean	0.336
KM SD (logged)	0.989	95% Critical H Value (KM-Log)	2.622
KM Standard Error of Mean (logged)	0.247	95% H-UCL (KM -Log)	1.026
KM SD (logged)	0.989	95% Critical H Value (KM-Log)	2.622
KM Standard Error of Mean (logged)	0.247		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.716	Mean in Log Scale	-1.438
SD in Original Scale	1.515	SD in Log Scale	1.242
95% t UCL (Assumes normality)	1.337	95% H-Stat UCL	1.269

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	2.349

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium

General Statistics

Total Number of Observations	18	Number of Distinct Observations	15
		Number of Missing Observations	3
Number of Detects	15	Number of Non-Detects	3
Number of Distinct Detects	13	Number of Distinct Non-Detects	2
Minimum Detect	0.91	Minimum Non-Detect	0.82
Maximum Detect	460	Maximum Non-Detect	7.5
Variance Detects	20809	Percent Non-Detects	16.67%
Mean Detects	62.73	SD Detects	144.3
Median Detects	8.6	CV Detects	2.3
Skewness Detects	2.457	Kurtosis Detects	4.846
Mean of Logged Detects	2.136	SD of Logged Detects	1.951

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.474	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.456	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	52.47	KM Standard Error of Mean	31.54
KM SD	129.3	95% KM (BCA) UCL	115.5
95% KM (t) UCL	107.3	95% KM (Percentile Bootstrap) UCL	104.2
95% KM (z) UCL	104.4	95% KM Bootstrap t UCL	846.6
90% KM Chebyshev UCL	147.1	95% KM Chebyshev UCL	189.9
97.5% KM Chebyshev UCL	249.4	99% KM Chebyshev UCL	366.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.692	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.827	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.312	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.239	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.338	k star (bias corrected MLE)	0.315
Theta hat (MLE)	185.7	Theta star (bias corrected MLE)	199.4
nu hat (MLE)	10.13	nu star (bias corrected)	9.439
Mean (detects)	62.73		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	52.28
Maximum	460	Median	4.3
SD	133.1	CV	2.546
k hat (MLE)	0.242	k star (bias corrected MLE)	0.239
Theta hat (MLE)	215.6	Theta star (bias corrected MLE)	218.7
nu hat (MLE)	8.729	nu star (bias corrected)	8.607
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (8.61, α)	3.092	Adjusted Chi Square Value (8.61, β)	2.782
95% Gamma Approximate UCL (use when n>=50)	145.5	95% Gamma Adjusted UCL (use when n<50)	161.7

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Vanadium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	52.47	SD (KM)	129.3
Variance (KM)	16711	SE of Mean (KM)	31.54
k hat (KM)	0.165	k star (KM)	0.174
nu hat (KM)	5.931	nu star (KM)	6.276
theta hat (KM)	318.5	theta star (KM)	301
80% gamma percentile (KM)	63.79	90% gamma percentile (KM)	158
95% gamma percentile (KM)	279.7	99% gamma percentile (KM)	622.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.28, α)	1.783	Adjusted Chi Square Value (6.28, β)	1.563
95% Gamma Approximate KM-UCL (use when n>=50)	184.7	95% Gamma Adjusted KM-UCL (use when n<50)	210.7

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.887	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.17	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	52.35	Mean in Log Scale	1.533
SD in Original Scale	133.1	SD in Log Scale	2.303
95% t UCL (assumes normality of ROS data)	106.9	95% Percentile Bootstrap UCL	103.1
95% BCA Bootstrap UCL	122.2	95% Bootstrap t UCL	812.4
95% H-UCL (Log ROS)	997.3		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	1.779	KM Geo Mean	5.927
KM SD (logged)	1.905	95% Critical H Value (KM-Log)	4.143
KM Standard Error of Mean (logged)	0.466	95% H-UCL (KM -Log)	247
KM SD (logged)	1.905	95% Critical H Value (KM-Log)	4.143
KM Standard Error of Mean (logged)	0.466		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	52.53	Mean in Log Scale	1.755
SD in Original Scale	133	SD in Log Scale	2.024
95% t UCL (Assumes normality)	107.1	95% H-Stat UCL	380.8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

97.5% KM (Chebyshev) UCL	249.4	99% KM (Chebyshev) UCL	366.3

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	18	Number of Distinct Observations	16
		Number of Missing Observations	3
Number of Detects	14	Number of Non-Detects	4
Number of Distinct Detects	14	Number of Distinct Non-Detects	2
Minimum Detect	16	Minimum Non-Detect	15
Maximum Detect	4000	Maximum Non-Detect	170
Variance Detects	1008303	Percent Non-Detects	22.22%
Mean Detects	800.9	SD Detects	1004
Median Detects	510	CV Detects	1.254
Skewness Detects	2.828	Kurtosis Detects	8.926
Mean of Logged Detects	5.993	SD of Logged Detects	1.507

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.646	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.306	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	626.3	KM Standard Error of Mean	223.5
KM SD	913.7	95% KM (BCA) UCL	1008
95% KM (t) UCL	1015	95% KM (Percentile Bootstrap) UCL	1046
95% KM (z) UCL	993.9	95% KM Bootstrap t UCL	1504
90% KM Chebyshev UCL	1297	95% KM Chebyshev UCL	1601
97.5% KM Chebyshev UCL	2022	99% KM Chebyshev UCL	2850

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.699	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.766	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.212	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.237	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.85	k star (bias corrected MLE)	0.715
Theta hat (MLE)	942.8	Theta star (bias corrected MLE)	1120
nu hat (MLE)	23.79	nu star (bias corrected)	20.02
Mean (detects)	800.9		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	622.9
Maximum	4000	Median	430
SD	942.6	CV	1.513
k hat (MLE)	0.253	k star (bias corrected MLE)	0.248
Theta hat (MLE)	2458	Theta star (bias corrected MLE)	2510
nu hat (MLE)	9.122	nu star (bias corrected)	8.935
Adjusted Level of Significance (β)	0.0357		
Approximate Chi Square Value (8.94, α)	3.288	Adjusted Chi Square Value (8.94, β)	2.967
95% Gamma Approximate UCL (use when n>=50)	1693	95% Gamma Adjusted UCL (use when n<50)	1876

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	626.3	SD (KM)	913.7
Variance (KM)	834938	SE of Mean (KM)	223.5
k hat (KM)	0.47	k star (KM)	0.429
nu hat (KM)	16.91	nu star (KM)	15.43
theta hat (KM)	1333	theta star (KM)	1461
80% gamma percentile (KM)	1018	90% gamma percentile (KM)	1747
95% gamma percentile (KM)	2541	99% gamma percentile (KM)	4522

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (15.43, α)	7.56	Adjusted Chi Square Value (15.43, β)	7.036
95% Gamma Approximate KM-UCL (use when n>=50)	1278	95% Gamma Adjusted KM-UCL (use when n<50)	1373

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.822	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.29	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	627.7	Mean in Log Scale	5.314
SD in Original Scale	939.3	SD in Log Scale	1.872
95% t UCL (assumes normality of ROS data)	1013	95% Percentile Bootstrap UCL	1011
95% BCA Bootstrap UCL	1179	95% Bootstrap t UCL	1517
95% H-UCL (Log ROS)	7492		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.265	KM Geo Mean	193.4
KM SD (logged)	1.869	95% Critical H Value (KM-Log)	4.078
KM Standard Error of Mean (logged)	0.457	95% H-UCL (KM -Log)	7047
KM SD (logged)	1.869	95% Critical H Value (KM-Log)	4.078
KM Standard Error of Mean (logged)	0.457		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	628.9	Mean in Log Scale	5.244
SD in Original Scale	938.6	SD in Log Scale	2.019
95% t UCL (Assumes normality)	1014	95% H-Stat UCL	12210

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50 but k<=1)	1373

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.23.2

Summary of ProUCL Output for Floodplain Groundwater
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/10/2019 9:07:54 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	10
Number of Detects	1	Number of Non-Detects	4
Number of Distinct Detects	1	Number of Distinct Non-Detects	4

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1248 (PCB-1248) was not processed!

Aroclor-1260 (PCB-1260)

General Statistics

Total Number of Observations	5	Number of Distinct Observations	5
		Number of Missing Observations	10
Number of Detects	1	Number of Non-Detects	4
Number of Distinct Detects	1	Number of Distinct Non-Detects	4

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1260 (PCB-1260) was not processed!

Table B.24.1

Summary of ProUCL Input Data for Quarry Pond Sediment Bioaccumalation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10	11
OU Designation:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Acenaphthene	D_Acenaphthene	Acenaphthylene	D_Acenaphthylene	Anthracene	D_Anthracene	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene
Quarry Pond	SD-01	9/25/2018	0-0.5 ft BGS	7.8	0	11	0	24	1	150	1	160	1	220	1
Quarry Pond	SD-02	9/21/2018	0-0.5 ft BGS	4.8	1	5.5	0	6.5	1	41	1	44	1	79	1
Quarry Pond	SD-03	9/21/2018	0-0.5 ft BGS	16	0	23	0	28	1	180	1	230	1	290	1
Quarry Pond	SD-04	9/21/2018	0-0.5 ft BGS	15	1	17	1	49	1	310	1	360	1	490	1
Quarry Pond	SD-04	9/21/2018	0.5-1.5 ft BGS	80	1	88	1	290	1	1200	1	1200	1	1700	1
Quarry Pond	SD-05	9/20/2018	0-0.5 ft BGS	13	1	20	1	46	1	300	1	310	1	450	1
Quarry Pond	SD-05	9/21/2018	0.5-1.5 ft BGS	160	1	120	1	390	1	1800	1	1700	1	2400	1
Quarry Pond	SD-06	9/21/2018	0-0.5 ft BGS	11	0	15	0	13	1	77	1	97	1	130	1
Quarry Pond	SD-06	9/25/2018	0.5-1.5 ft BGS	9.7	1	11	1	22	1	110	1	140	1	160	1
Quarry Pond	SD-07	9/25/2018	0-0.5 ft BGS	5.5	0	7.7	0	7	1	52	1	68	1	99	1
Quarry Pond	SD-08	9/25/2018	0-0.5 ft BGS	14	1	13	0	35	1	180	1	220	1	310	1
Quarry Pond	SD-08	9/25/2018	0.5-1.5 ft BGS	14	1	14	1	31	1	170	1	200	1	290	1
Quarry Pond	SD-10	9/25/2018	0-0.5 ft BGS	12	0	16	0	15	1	79	1	110	1	170	1
Quarry Pond	SD-11	9/25/2018	0-0.5 ft BGS	8.1	0	11	0	12	1	76	1	99	1	150	1
Quarry Pond	SD-11	9/25/2018	0.5-1.5 ft BGS	6.5	0	9.2	0	5.5	0	31	1	38	1	50	1
Quarry Pond	SD-12	9/26/2018	0-0.5 ft BGS	8.2	0	11	0	13	1	72	1	89	1	110	1
Quarry Pond	SD-13	9/25/2018	0-0.5 ft BGS	36	1	13	0	86	1	450	1	530	1	750	1
Quarry Pond	SD-13	9/25/2018	0.5-1.5 ft BGS	31	1	12	1	64	1	250	1	280	1	390	1
Quarry Pond	SD-14	9/26/2018	0-0.5 ft BGS	10	0	14	0	13	1	91	1	110	1	180	1
Quarry Pond	SD-14	9/26/2018	0.5-1.5 ft BGS	19	1	13	1	39	1	190	1	190	1	310	1
Quarry Pond	SD-15	9/26/2018	0-0.5 ft BGS	9.2	0	13	0	17	1	110	1	120	1	160	1
Quarry Pond	SD-16	9/26/2018	0-0.5 ft BGS	3.5	0	5	0	11	1	44	1	49	1	67	1
Quarry Pond	SD-17	9/21/2018	0-0.5 ft BGS	2900	1	260	0	7800	1	26000	1	22000	1	33000	1
Quarry Pond	SD-18	9/24/2018	0-0.5 ft BGS	8.2	0	12	0	21	1	120	1	130	1	200	1
Quarry Pond	SD-19	9/24/2018	0-0.5 ft BGS	9.1	0	13	0	7.6	0	57	1	61	1	86	1
Quarry Pond	SD-19	9/24/2018	0.5-1.5 ft BGS	13	1	11	1	26	1	120	1	130	1	200	1
Quarry Pond	SD-20	9/21/2018	0-0.5 ft BGS	10	1	9.2	0	20	1	130	1	150	1	210	1
Quarry Pond	SD-05A	10/4/2019	0-0.5 ft BSS	5.7	0	8	0	16	1	74	1	96	1	130	1
Quarry Pond	SD-05B	10/4/2019	0-0.5 ft BSS	5.8	0	8.1	0	6.8	1	46	1	54	1	67	1
Quarry Pond	SD-17A	10/3/2019	0-0.5 ft BSS	57	1	46	1	220	1	910	1	1000	1	1300	1
Quarry Pond	SD-17A	10/3/2019	0.5-1.3 ft BSS	110	1	43	1	350	1	1400	1	1400	1	1800	1
Quarry Pond	SD-17B	10/3/2019	0-0.5 ft BSS	55.5	1	9.9	0	135	1	620	1	605	1	865	1
Quarry Pond	SD-17C	10/4/2019	0-0.5 ft BSS	27	1	16	1	97	1	290	1	290	1	400	1
Quarry Pond	SD-17C	10/4/2019	0.5-0.85 ft BSS	110	1	42	1	370	1	1400	1	1400	1	1700	1
Quarry Pond	SD-17D	10/4/2019	0-0.5 ft BSS	100	1	10	0	280	1	1200	1	1200	1	1600	1
Quarry Pond	SD-17D	10/4/2019	0.5-0.92 ft BSS	75	1	62	1	370	1	1200	1	1400	1	2000	1
Quarry Pond	SD-17E	10/4/2019	0-0.5 ft BSS	320	1	27	0	770	1	3200	1	2800	1	3200	1

Table B.24.1

Summary of ProUCL Input Data for Quarry Pond Sediment Bioaccumalation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

			12	13	14	15	16	17	18	19	20	21	22	23
Sample Location:	**Sample Date:**	**Sample Depth:**	Benzo(g,h,i)perylene	D_Benzo(g,h,i)perylene	Benzo(k)fluoranthene	D_Benzo(k)fluoranthene	Chrysene	D_Chrysene	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Fluoranthene	D_Fluoranthene	Fluorene	D_Fluorene
SD-01	9/25/2018	0-0.5 ft BGS	95	1	98	1	160	1	25	1	300	1	7.4	0
SD-02	9/21/2018	0-0.5 ft BGS	36	1	19	1	54	1	9.4	0	92	1	5.1	1
SD-03	9/21/2018	0-0.5 ft BGS	140	1	100	1	220	1	40	0	380	1	16	0
SD-04	9/21/2018	0-0.5 ft BGS	220	1	180	1	370	1	52	1	610	1	19	1
SD-04	9/21/2018	0.5-1.5 ft BGS	730	1	470	1	1300	1	220	1	2900	1	99	1
SD-05	9/20/2018	0-0.5 ft BGS	180	1	140	1	330	1	42	1	570	1	16	1
SD-05	9/21/2018	0.5-1.5 ft BGS	1100	1	950	1	1800	1	260	1	4600	1	220	1
SD-06	9/21/2018	0-0.5 ft BGS	83	1	48	1	94	1	26	0	160	1	10	0
SD-06	9/25/2018	0.5-1.5 ft BGS	85	1	69	1	130	1	20	1	280	1	11	1
SD-07	9/25/2018	0-0.5 ft BGS	42	1	36	1	68	1	13	0	110	1	5.2	0
SD-08	9/25/2018	0-0.5 ft BGS	100	1	120	1	210	1	29	1	420	1	15	1
SD-08	9/25/2018	0.5-1.5 ft BGS	80	1	98	1	190	1	24	1	380	1	15	1
SD-10	9/25/2018	0-0.5 ft BGS	76	1	66	1	100	1	28	0	210	1	11	0
SD-11	9/25/2018	0-0.5 ft BGS	67	1	50	1	93	1	20	0	170	1	7.7	0
SD-11	9/25/2018	0.5-1.5 ft BGS	20	1	23	1	38	1	16	0	78	1	6.3	0
SD-12	9/26/2018	0-0.5 ft BGS	59	1	42	1	82	1	20	0	150	1	7.8	0
SD-13	9/25/2018	0-0.5 ft BGS	180	1	230	1	550	1	71	1	980	1	37	1
SD-13	9/25/2018	0.5-1.5 ft BGS	150	1	150	1	290	1	42	1	610	1	35	1
SD-14	9/26/2018	0-0.5 ft BGS	41	1	64	1	110	1	25	0	190	1	9.8	0
SD-14	9/26/2018	0.5-1.5 ft BGS	150	1	100	1	230	1	38	1	450	1	23	1
SD-15	9/26/2018	0-0.5 ft BGS	110	1	87	1	140	1	22	0	220	1	11	1
SD-16	9/26/2018	0-0.5 ft BGS	30	1	27	1	54	1	8.6	0	100	1	5.1	1
SD-17	9/21/2018	0-0.5 ft BGS	11000	1	9300	1	29000	1	3700	1	59000	1	3000	1
SD-18	9/24/2018	0-0.5 ft BGS	100	1	70	1	150	1	20	0	270	1	10	1
SD-19	9/24/2018	0-0.5 ft BGS	50	1	40	1	62	1	22	0	110	1	8.7	0
SD-19	9/24/2018	0.5-1.5 ft BGS	99	1	70	1	150	1	26	1	270	1	16	1
SD-20	9/21/2018	0-0.5 ft BGS	88	1	74	1	170	1	23	1	290	1	9.6	1
SD-05A	10/4/2019	0-0.5 ft BSS	58	1	46	1	85	1	14	0	160	1	6.8	1
SD-05B	10/4/2019	0-0.5 ft BSS	41	1	26	1	47	1	14	0	68	1	5.5	0
SD-17A	10/3/2019	0-0.5 ft BSS	380	1	610	1	970	1	100	1	1600	1	76	1
SD-17A	10/3/2019	0.5-1.3 ft BSS	780	1	730	1	1700	1	240	1	2900	1	100	1
SD-17B	10/3/2019	0-0.5 ft BSS	375	1	220	1	640	1	123.5	1	1140	1	53	1
SD-17C	10/4/2019	0-0.5 ft BSS	190	1	160	1	310	1	16	0	600	1	36	1
SD-17C	10/4/2019	0.5-0.85 ft BSS	690	1	790	1	1300	1	240	1	2500	1	160	1
SD-17D	10/4/2019	0-0.5 ft BSS	790	1	730	1	1200	1	230	1	2500	1	110	1
SD-17D	10/4/2019	0.5-0.92 ft BSS	510	1	810	1	1200	1	160	1	2200	1	130	1
SD-17E	10/4/2019	0-0.5 ft BSS	1600	1	1500	1	3000	1	510	1	5800	1	310	1

Table B.24.1

Summary of ProUCL Input Data for Quarry Pond Sediment Bioaccumalation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

			24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
Sample Location:	**Sample Date:**	**Sample Depth:**	Indeno(1,2,3-cd)pyrene	D_Indeno(1,2,3-cd)pyrene	Phenanthrene	D_Phenanthrene	Pyrene	D_Pyrene	Arsenic	D_Arsenic	Cadmium	D_Cadmium	Chromium	D_Chromium	Copper	D_Copper	Lead	D_Lead
SD-01	9/25/2018	0-0.5 ft BGS	79	1	110	1	240	1	8.7	1	0.35	1	16	1	23	1	140	1
SD-02	9/21/2018	0-0.5 ft BGS	31	1	48	1	76	1	3.1	1	0.12	1	6	1	5.5	1	8.6	1
SD-03	9/21/2018	0-0.5 ft BGS	140	1	120	1	330	1	11	1	0.36	1	13	1	23	1	25	1
SD-04	9/21/2018	0-0.5 ft BGS	220	1	200	1	540	1	11	1	0.26	1	11	1	17	1	18	1
SD-04	9/21/2018	0.5-1.5 ft BGS	650	1	1100	1	2100	1	11	1	0.49	1	14	1	26	1	65	1
SD-05	9/20/2018	0-0.5 ft BGS	170	1	180	1	500	1	8.4	1	0.21	1	10	1	12	1	16	1
SD-05	9/21/2018	0.5-1.5 ft BGS	910	1	1800	1	3400	1	7.9	1	0.46	1	11	1	20	1	52	1
SD-06	9/21/2018	0-0.5 ft BGS	66	1	53	1	150	1	20	1	0.52	1	19	1	29	1	41	1
SD-06	9/25/2018	0.5-1.5 ft BGS	76	1	110	1	210	1	13	1	0.86	1	20	1	39	1	94	1
SD-07	9/25/2018	0-0.5 ft BGS	32	1	38	1	96	1	7.6	1	0.13	1	9.5	1	7.6	1	7.2	1
SD-08	9/25/2018	0-0.5 ft BGS	95	1	160	1	330	1	14	1	0.45	1	15	1	29	1	36	1
SD-08	9/25/2018	0.5-1.5 ft BGS	76	1	110	1	320	1	12	1	0.43	1	17	1	28	1	38	1
SD-10	9/25/2018	0-0.5 ft BGS	73	1	71	1	170	1	24	1	0.61	1	20	1	34	1	40	1
SD-11	9/25/2018	0-0.5 ft BGS	59	1	57	1	130	1	14	1	0.38	1	13	1	24	1	21	1
SD-11	9/25/2018	0.5-1.5 ft BGS	20	1	27	1	57	1	23	1	0.54	1	19	1	37	1	37	1
SD-12	9/26/2018	0-0.5 ft BGS	47	1	58	1	130	1	6.8	1	0.24	1	8.3	1	14	1	15	1
SD-13	9/25/2018	0-0.5 ft BGS	200	1	400	1	800	1	15	1	0.58	1	17	1	34	1	48	1
SD-13	9/25/2018	0.5-1.5 ft BGS	130	1	270	1	470	1	11	1	0.5	1	15	1	31	1	49	1
SD-14	9/26/2018	0-0.5 ft BGS	45	1	67	1	160	1	12	1	0.5	1	14	1	24	1	25	1
SD-14	9/26/2018	0.5-1.5 ft BGS	130	1	240	1	360	1	12	1	0.64	1	19	1	30	1	37	1
SD-15	9/26/2018	0-0.5 ft BGS	88	1	79	1	200	1	13	1	0.34	1	12	1	19	1	20	1
SD-16	9/26/2018	0-0.5 ft BGS	29	1	51	1	76	1	6.4	1	0.059	1	3.7	1	2.9	1	3.2	1
SD-17	9/21/2018	0-0.5 ft BGS	11000	1	37000	1	41000	1	7.9	1	0.37	1	12	1	19	1	35	1
SD-18	9/24/2018	0-0.5 ft BGS	86	1	120	1	230	1	9.2	1	0.41	1	15	1	24	1	26	1
SD-19	9/24/2018	0-0.5 ft BGS	46	1	43	1	100	1	15	1	0.45	1	16	1	27	1	27	1
SD-19	9/24/2018	0.5-1.5 ft BGS	87	1	150	1	240	1	14	1	0.51	1	19	1	32	1	37	1
SD-20	9/21/2018	0-0.5 ft BGS	83	1	110	1	240	1	10	1	0.26	1	16	1	18	1	17	1
SD-05A	10/4/2019	0-0.5 ft BSS	58	1	63	1	130	1										
SD-05B	10/4/2019	0-0.5 ft BSS	15	0	35	1	73	1										
SD-17A	10/3/2019	0-0.5 ft BSS	390	1	910	1	1500	1										
SD-17A	10/3/2019	0.5-1.3 ft BSS	710	1	1400	1	2400	1										
SD-17B	10/3/2019	0-0.5 ft BSS	330	1	635	1	1005	1										
SD-17C	10/4/2019	0-0.5 ft BSS	170	1	390	1	500	1										
SD-17C	10/4/2019	0.5-0.85 ft BSS	630	1	1600	1	2000	1										
SD-17D	10/4/2019	0-0.5 ft BSS	720	1	1400	1	2000	1										
SD-17D	10/4/2019	0.5-0.92 ft BSS	530	1	1700	1	1800	1										
SD-17E	10/4/2019	0-0.5 ft BSS	1400	1	3800	1	5300	1										

Table B.24.1

Summary of ProUCL Input Data for Quarry Pond Sediment Bioaccumalation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

			40	41	42	43	44	45	46	47	48	49	50	51	52	53
Sample Location:	**Sample Date:**	**Sample Depth:**	Mercury	D_Mercury	Methyl mercury	D_Methyl mercury	Nickel	D_Nickel	Selenium	D_Selenium	Silver	D_Silver	Zinc	D_Zinc	Aroclor-1242 (PCB-1242)	D_Aroclor-1242 (PCB-1242)
SD-01	9/25/2018	0-0.5 ft BGS	0.051	1	0.00065	1	14	1	0.89	1	0.08	1	76	1	49	0
SD-02	9/21/2018	0-0.5 ft BGS	0.023	0	0.000097	0	6	1	0.14	1	0.025	0	29	1	26	0
SD-03	9/21/2018	0-0.5 ft BGS	0.1	0	0.00042	0	15	1	1.8	1	0.12	0	86	1	100	0
SD-04	9/21/2018	0-0.5 ft BGS	0.059	1	0.00026	1	14	1	0.61	1	0.049	1	65	1	51	0
SD-04	9/21/2018	0.5-1.5 ft BGS	0.17	1	0.00014	1	17	1	0.77	1	0.086	1	110	1	36	0
SD-05	9/20/2018	0-0.5 ft BGS	0.057	1	0.00026	1	12	1	0.4	1	0.054	0	52	1	52	0
SD-05	9/21/2018	0.5-1.5 ft BGS	0.097	1	0.00031	1	13	1	0.47	1	0.061	1	71	1	29	0
SD-06	9/21/2018	0-0.5 ft BGS	0.089	1	0.00027	1	21	1	1.2	1	0.12	1	150	1	68	0
SD-06	9/25/2018	0.5-1.5 ft BGS	0.1	1	0.00024	1	20	1	1.1	1	0.1	1	390	1	88	1
SD-07	9/25/2018	0-0.5 ft BGS	0.034	0	0.00014	0	8.1	1	0.31	1	0.35	1	28	1	43	1
SD-08	9/25/2018	0-0.5 ft BGS	0.081	1	0.00021	0	18	1	0.95	1	0.11	1	100	1	60	1
SD-08	9/25/2018	0.5-1.5 ft BGS	0.072	1	0.00014	0	20	1	0.73	1	0.079	1	96	1	37	0
SD-10	9/25/2018	0-0.5 ft BGS	0.063	0	0.00033	1	25	1	1.6	1	0.12	1	160	1	76	0
SD-11	9/25/2018	0-0.5 ft BGS	0.056	0	0.0002	0	18	1	0.76	1	0.071	1	89	1	61	1
SD-11	9/25/2018	0.5-1.5 ft BGS	0.1	1	0.00016	0	26	1	1	1	0.11	1	130	1	83	1
SD-12	9/26/2018	0-0.5 ft BGS	0.061	1	0.0002	0	11	1	0.73	1	0.055	0	54	1	54	0
SD-13	9/25/2018	0-0.5 ft BGS	0.11	1	0.00022	0	21	1	1.1	1	0.11	1	150	1	130	1
SD-13	9/25/2018	0.5-1.5 ft BGS	0.092	1	0.00046	1	19	1	0.71	1	0.078	1	120	1	71	1
SD-14	9/26/2018	0-0.5 ft BGS	0.1	1	0.00069	1	17	1	1.2	1	0.13	1	90	1	67	0
SD-14	9/26/2018	0.5-1.5 ft BGS	0.11	1	0.00051	1	19	1	1.2	1	0.22	1	110	1	46	0
SD-15	9/26/2018	0-0.5 ft BGS	0.07	1	0.00055	1	16	1	0.82	1	0.068	1	77	1	61	0
SD-16	9/26/2018	0-0.5 ft BGS	0.021	0	0.000087	0	4.1	1	0.12	0	0.022	0	13	1	23	0
SD-17	9/21/2018	0-0.5 ft BGS	0.068	1	0.00061	1	11	1	0.28	1	0.055	1	62	1	30	0
SD-18	9/24/2018	0-0.5 ft BGS	0.046	0	0.0002	0	17	1	0.97	1	0.13	1	84	1	55	1
SD-19	9/24/2018	0-0.5 ft BGS	0.062	1	0.00023	0	20	1	1.1	1	0.084	1	100	1	60	1
SD-19	9/24/2018	0.5-1.5 ft BGS	0.1	1	0.00026	1	21	1	1.1	1	0.099	1	120	1	77	1
SD-20	9/21/2018	0-0.5 ft BGS	0.049	1	0.00048	1	18	1	0.62	1	0.061	1	69	1	43	0
SD-05A	10/4/2019	0-0.5 ft BSS														
SD-05B	10/4/2019	0-0.5 ft BSS														
SD-17A	10/3/2019	0-0.5 ft BSS														
SD-17A	10/3/2019	0.5-1.3 ft BSS														
SD-17B	10/3/2019	0-0.5 ft BSS														
SD-17C	10/4/2019	0-0.5 ft BSS														
SD-17C	10/4/2019	0.5-0.85 ft BSS														
SD-17D	10/4/2019	0-0.5 ft BSS														
SD-17D	10/4/2019	0.5-0.92 ft BSS														
SD-17E	10/4/2019	0-0.5 ft BSS														

Table B.24.1

Summary of ProUCL Input Data for Quarry Pond Sediment Bioaccumalation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

			54	55	56	57	58	59
Sample Location:	**Sample Date:**	**Sample Depth:**	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)	alpha-Chlordane	D_alpha-Chlordane	gamma-Chlordane	D_gamma-Chlordane
SD-01	9/25/2018	0-0.5 ft BGS	60	0	3.9	0	3.2	0
SD-02	9/21/2018	0-0.5 ft BGS	31	0	2	0	1.7	0
SD-03	9/21/2018	0-0.5 ft BGS	130	0	8.7	0	7.2	0
SD-04	9/21/2018	0-0.5 ft BGS	61	0	3.9	0	3.2	0
SD-04	9/21/2018	0.5-1.5 ft BGS	43	0	2.9	0	2.4	0
SD-05	9/20/2018	0-0.5 ft BGS	63	0	4.1	0	3.4	0
SD-05	9/21/2018	0.5-1.5 ft BGS	75	1	5.5	1	4.7	1
SD-06	9/21/2018	0-0.5 ft BGS	83	0	28	0	23	0
SD-06	9/25/2018	0.5-1.5 ft BGS	69	1	2.9	0	3.5	1
SD-07	9/25/2018	0-0.5 ft BGS	43	0	2.8	0	2.3	0
SD-08	9/25/2018	0-0.5 ft BGS	72	0	4.7	0	3.9	0
SD-08	9/25/2018	0.5-1.5 ft BGS	44	0	2.9	0	2.4	0
SD-10	9/25/2018	0-0.5 ft BGS	92	0	6	0	4.9	0
SD-11	9/25/2018	0-0.5 ft BGS	65	0	4.3	0	3.5	0
SD-11	9/25/2018	0.5-1.5 ft BGS	52	0	3.4	0	2.8	0
SD-12	9/26/2018	0-0.5 ft BGS	65	0	4.2	0	3.5	0
SD-13	9/25/2018	0-0.5 ft BGS	74	0	4.8	0	3.9	0
SD-13	9/25/2018	0.5-1.5 ft BGS	36	0	2.3	0	2.3	1
SD-14	9/26/2018	0-0.5 ft BGS	81	0	5.3	0	12	1
SD-14	9/26/2018	0.5-1.5 ft BGS	78	1	3.6	0	3	0
SD-15	9/26/2018	0-0.5 ft BGS	74	0	4.8	0	4.5	1
SD-16	9/26/2018	0-0.5 ft BGS	28	0	1.8	0	1.5	0
SD-17	9/21/2018	0-0.5 ft BGS	420	1	48	0	40	0
SD-18	9/24/2018	0-0.5 ft BGS	67	0	4.4	0	3.6	0
SD-19	9/24/2018	0-0.5 ft BGS	73	0	4.7	0	3.9	0
SD-19	9/24/2018	0.5-1.5 ft BGS	51	0	3.3	0	2.7	0
SD-20	9/21/2018	0-0.5 ft BGS	52	0	17	0	14	0
SD-05A	10/4/2019	0-0.5 ft BSS						
SD-05B	10/4/2019	0-0.5 ft BSS						
SD-17A	10/3/2019	0-0.5 ft BSS						
SD-17A	10/3/2019	0.5-1.3 ft BSS						
SD-17B	10/3/2019	0-0.5 ft BSS						
SD-17C	10/4/2019	0-0.5 ft BSS						
SD-17C	10/4/2019	0.5-0.85 ft BSS						
SD-17D	10/4/2019	0-0.5 ft BSS						
SD-17D	10/4/2019	0.5-0.92 ft BSS						
SD-17E	10/4/2019	0-0.5 ft BSS						

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Acenaphthene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	32
Number of Detects	22	Number of Non-Detects	15
Number of Distinct Detects	19	Number of Distinct Non-Detects	14
Minimum Detect	4.8	Minimum Non-Detect	3.5
Maximum Detect	2900	Maximum Non-Detect	16
Variance Detects	371579	Percent Non-Detects	40.54%
Mean Detects	189.7	SD Detects	609.6
Median Detects	33.5	CV Detects	3.213
Skewness Detects	4.588	Kurtosis Detects	21.3
Mean of Logged Detects	3.732	SD of Logged Detects	1.438

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.301	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.429	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	114.6	KM Standard Error of Mean	78.78
KM SD	468.2	95% KM (BCA) UCL	269.7
95% KM (t) UCL	247.6	95% KM (Percentile Bootstrap) UCL	264
95% KM (z) UCL	244.2	95% KM Bootstrap t UCL	1246
90% KM Chebyshev UCL	350.9	95% KM Chebyshev UCL	458
97.5% KM Chebyshev UCL	606.6	99% KM Chebyshev UCL	898.4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.509	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.819	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.286	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.198	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.43	k star (bias corrected MLE)	0.401
Theta hat (MLE)	441.5	Theta star (bias corrected MLE)	472.6
nu hat (MLE)	18.91	nu star (bias corrected)	17.66
Mean (detects)	189.7		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	112.8
Maximum	2900	Median	13
SD	475	CV	4.211
k hat (MLE)	0.172	k star (bias corrected MLE)	0.176
Theta hat (MLE)	655.3	Theta star (bias corrected MLE)	640.2
nu hat (MLE)	12.74	nu star (bias corrected)	13.04
Adjusted Level of Significance (β)	0.0431		
Approximate Chi Square Value (13.04, α)	5.92	Adjusted Chi Square Value (13.04, β)	5.712
95% Gamma Approximate UCL (use when n>=50)	248.5	95% Gamma Adjusted UCL (use when n<50)	257.6

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Acenaphthene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	114.6	SD (KM)	468.2
Variance (KM)	219174	SE of Mean (KM)	78.78
k hat (KM)	0.0599	k star (KM)	0.0731
nu hat (KM)	4.435	nu star (KM)	5.408
theta hat (KM)	1912	theta star (KM)	1568
80% gamma percentile (KM)	45.24	90% gamma percentile (KM)	255.5
95% gamma percentile (KM)	662.3	99% gamma percentile (KM)	2117

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.41, α)	1.345	Adjusted Chi Square Value (5.41, β)	1.261
95% Gamma Approximate KM-UCL (use when n>=50)	460.7	95% Gamma Adjusted KM-UCL (use when n<50)	491.7

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.125	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	113.6	Mean in Log Scale	2.448
SD in Original Scale	474.9	SD in Log Scale	1.937
95% t UCL (assumes normality of ROS data)	245.4	95% Percentile Bootstrap UCL	267.6
95% BCA Bootstrap UCL	357.6	95% Bootstrap t UCL	1227
95% H-UCL (Log ROS)	244.6		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.805	KM Geo Mean	16.52
KM SD (logged)	1.569	95% Critical H Value (KM-Log)	3.113
KM Standard Error of Mean (logged)	0.269	95% H-UCL (KM -Log)	127.7
KM SD (logged)	1.569	95% Critical H Value (KM-Log)	3.113
KM Standard Error of Mean (logged)	0.269		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	114.5	Mean in Log Scale	2.778
SD in Original Scale	474.6	SD in Log Scale	1.623
95% t UCL (Assumes normality)	246.3	95% H-Stat UCL	142

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	127.7

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Acenaphthylene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	25
Number of Detects	14	Number of Non-Detects	23
Number of Distinct Detects	13	Number of Distinct Non-Detects	17
Minimum Detect	11	Minimum Non-Detect	5
Maximum Detect	120	Maximum Non-Detect	260
Variance Detects	1113	Percent Non-Detects	62.16%
Mean Detects	36.79	SD Detects	33.36
Median Detects	18.5	CV Detects	0.907
Skewness Detects	1.526	Kurtosis Detects	1.841
Mean of Logged Detects	3.272	SD of Logged Detects	0.823

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.785	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.264	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	17.84	KM Standard Error of Mean	4.367
KM SD	25.17	95% KM (BCA) UCL	27.03
95% KM (t) UCL	25.21	95% KM (Percentile Bootstrap) UCL	25.07
95% KM (z) UCL	25.02	95% KM Bootstrap t UCL	30.08
90% KM Chebyshev UCL	30.94	95% KM Chebyshev UCL	36.88
97.5% KM Chebyshev UCL	45.11	99% KM Chebyshev UCL	61.29

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.818	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.749	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.24	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.232	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.647	k star (bias corrected MLE)	1.342
Theta hat (MLE)	22.33	Theta star (bias corrected MLE)	27.41
nu hat (MLE)	46.12	nu star (bias corrected)	37.57
Mean (detects)	36.79		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	13.93
Maximum	120	Median	0.01
SD	27	CV	1.939
k hat (MLE)	0.176	k star (bias corrected MLE)	0.18
Theta hat (MLE)	79.02	Theta star (bias corrected MLE)	77.38
nu hat (MLE)	13.04	nu star (bias corrected)	13.32
Adjusted Level of Significance (β)	0.0431		
Approximate Chi Square Value (13.32, α)	6.106	Adjusted Chi Square Value (13.32, β)	5.894
95% Gamma Approximate UCL (use when n>=50)	30.37	95% Gamma Adjusted UCL (use when n<50)	31.46

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Acenaphthylene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	17.84	SD (KM)	25.17
Variance (KM)	633.7	SE of Mean (KM)	4.367
k hat (KM)	0.502	k star (KM)	0.48
nu hat (KM)	37.17	nu star (KM)	35.49
theta hat (KM)	35.52	theta star (KM)	37.2
80% gamma percentile (KM)	29.24	90% gamma percentile (KM)	48.68
95% gamma percentile (KM)	69.56	99% gamma percentile (KM)	121.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (35.49, α)	22.86	Adjusted Chi Square Value (35.49, β)	22.42
95% Gamma Approximate KM-UCL (use when n>=50)	27.7	95% Gamma Adjusted KM-UCL (use when n<50)	28.24

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.883	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	16.06	Mean in Log Scale	1.949
SD in Original Scale	25.92	SD in Log Scale	1.211
95% t UCL (assumes normality of ROS data)	23.26	95% Percentile Bootstrap UCL	23.3
95% BCA Bootstrap UCL	25.2	95% Bootstrap t UCL	28.44
95% H-UCL (Log ROS)	24.89		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	2.315	KM Geo Mean	10.12
KM SD (logged)	0.936	95% Critical H Value (KM-Log)	2.317
KM Standard Error of Mean (logged)	0.167	95% H-UCL (KM -Log)	22.5
KM SD (logged)	0.936	95% Critical H Value (KM-Log)	2.317
KM Standard Error of Mean (logged)	0.167		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	21.01	Mean in Log Scale	2.391
SD in Original Scale	31.14	SD in Log Scale	1.041
95% t UCL (Assumes normality)	29.65	95% H-Stat UCL	28.68

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	22.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Anthracene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	34
Number of Detects	35	Number of Non-Detects	2
Number of Distinct Detects	32	Number of Distinct Non-Detects	2
Minimum Detect	6.5	Minimum Non-Detect	5.5
Maximum Detect	7800	Maximum Non-Detect	7.6
Variance Detects	1715821	Percent Non-Detects	5.405%
Mean Detects	334.1	SD Detects	1310
Median Detects	31	CV Detects	3.921
Skewness Detects	5.767	Kurtosis Detects	33.75
Mean of Logged Detects	3.941	SD of Logged Detects	1.615

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.252	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.934	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.426	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.148	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	316.4	KM Standard Error of Mean	209.8
KM SD	1258	95% KM (BCA) UCL	743.6
95% KM (t) UCL	670.6	95% KM (Percentile Bootstrap) UCL	731.2
95% KM (z) UCL	661.5	95% KM Bootstrap t UCL	2864
90% KM Chebyshev UCL	945.8	95% KM Chebyshev UCL	1231
97.5% KM Chebyshev UCL	1627	99% KM Chebyshev UCL	2404

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.836	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.844	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.243	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.16	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.358	k star (bias corrected MLE)	0.347
Theta hat (MLE)	932.6	Theta star (bias corrected MLE)	964
nu hat (MLE)	25.08	nu star (bias corrected)	24.26
Mean (detects)	334.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	316
Maximum	7800	Median	28
SD	1275	CV	4.035
k hat (MLE)	0.303	k star (bias corrected MLE)	0.296
Theta hat (MLE)	1045	Theta star (bias corrected MLE)	1068
nu hat (MLE)	22.39	nu star (bias corrected)	21.9
Adjusted Level of Significance (β)	0.0431		
Approximate Chi Square Value (21.90, α)	12.27	Adjusted Chi Square Value (21.90, β)	11.95
95% Gamma Approximate UCL (use when n>=50)	564.3	95% Gamma Adjusted UCL (use when n<50)	579.2

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	316.4	SD (KM)	1258
Variance (KM)	1582206	SE of Mean (KM)	209.8
k hat (KM)	0.0633	k star (KM)	0.0761
nu hat (KM)	4.681	nu star (KM)	5.635
theta hat (KM)	5001	theta star (KM)	4155
80% gamma percentile (KM)	136.3	90% gamma percentile (KM)	726.2
95% gamma percentile (KM)	1834	99% gamma percentile (KM)	5735

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.63, α)	1.456	Adjusted Chi Square Value (5.63, β)	1.367
95% Gamma Approximate KM-UCL (use when n>=50)	1224	95% Gamma Adjusted KM-UCL (use when n<50)	1304

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.905	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.934	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.141	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.148	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	316.1	Mean in Log Scale	3.757
SD in Original Scale	1275	SD in Log Scale	1.759
95% t UCL (assumes normality of ROS data)	670.1	95% Percentile Bootstrap UCL	728.5
95% BCA Bootstrap UCL	981.4	95% Bootstrap t UCL	2915
95% H-UCL (Log ROS)	541.9		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.825	KM Geo Mean	45.82
KM SD (logged)	1.624	95% Critical H Value (KM-Log)	3.188
KM Standard Error of Mean (logged)	0.271	95% H-UCL (KM -Log)	405.6
KM SD (logged)	1.624	95% Critical H Value (KM-Log)	3.188
KM Standard Error of Mean (logged)	0.271		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	316.2	Mean in Log Scale	3.792
SD in Original Scale	1275	SD in Log Scale	1.693
95% t UCL (Assumes normality)	670.2	95% H-Stat UCL	470.2

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1231

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	31
		Number of Missing Observations	0
Minimum	31	Mean	1155
Maximum	26000	Median	170
SD	4250	Std. Error of Mean	698.8
Coefficient of Variation	3.68	Skewness	5.857

Normal GOF Test

Shapiro Wilk Test Statistic	0.264	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.396	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2335	95% Adjusted-CLT UCL (Chen-1995)	3023
		95% Modified-t UCL (Johnson-1978)	2447

Gamma GOF Test

A-D Test Statistic	3.829	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.832	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.261	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.155	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.411	k star (bias corrected MLE)	0.396
Theta hat (MLE)	2808	Theta star (bias corrected MLE)	2916
nu hat (MLE)	30.44	nu star (bias corrected)	29.3
MLE Mean (bias corrected)	1155	MLE Sd (bias corrected)	1835
		Approximate Chi Square Value (0.05)	17.95
Adjusted Level of Significance	0.0431	Adjusted Chi Square Value	17.56

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1886	95% Adjusted Gamma UCL (use when n<50)	1927

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.913	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.152	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.434	Mean of logged Data	5.459
Maximum of Logged Data	10.17	SD of logged Data	1.472

Assuming Lognormal Distribution

95% H-UCL	1441	90% Chebyshev (MVUE) UCL	1267
95% Chebyshev (MVUE) UCL	1544	97.5% Chebyshev (MVUE) UCL	1928
99% Chebyshev (MVUE) UCL	2683		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	2304	95% Jackknife UCL	2335
95% Standard Bootstrap UCL	2292	95% Bootstrap-t UCL	8321
95% Hall's Bootstrap UCL	6537	95% Percentile Bootstrap UCL	2543
95% BCA Bootstrap UCL	3264		
90% Chebyshev(Mean, Sd) UCL	3251	95% Chebyshev(Mean, Sd) UCL	4201
97.5% Chebyshev(Mean, Sd) UCL	5519	99% Chebyshev(Mean, Sd) UCL	8108

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	4201

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	38	Mean	1056
Maximum	22000	Median	190
SD	3593	Std. Error of Mean	590.6
Coefficient of Variation	3.403	Skewness	5.809

Normal GOF Test

Shapiro Wilk Test Statistic	0.278	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.388	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2053	95% Adjusted-CLT UCL (Chen-1995)	2630
		95% Modified-t UCL (Johnson-1978)	2147

Gamma GOF Test

A-D Test Statistic	3.522	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.821	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.245	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.154	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.461	k star (bias corrected MLE)	0.442
Theta hat (MLE)	2289	Theta star (bias corrected MLE)	2389
nu hat (MLE)	34.13	nu star (bias corrected)	32.69
MLE Mean (bias corrected)	1056	MLE Sd (bias corrected)	1588
		Approximate Chi Square Value (0.05)	20.62
Adjusted Level of Significance	0.0431	Adjusted Chi Square Value	20.21

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1674	95% Adjusted Gamma UCL (use when n<50)	1708

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.917	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.132	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.144	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.638	Mean of logged Data	5.567
Maximum of Logged Data	9.999	SD of logged Data	1.389

Assuming Lognormal Distribution

95% H-UCL	1334	90% Chebyshev (MVUE) UCL	1221
95% Chebyshev (MVUE) UCL	1478	97.5% Chebyshev (MVUE) UCL	1834
99% Chebyshev (MVUE) UCL	2534		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2027	95% Jackknife UCL	2053
95% Standard Bootstrap UCL	2006	95% Bootstrap-t UCL	6444
95% Hall's Bootstrap UCL	5595	95% Percentile Bootstrap UCL	2167
95% BCA Bootstrap UCL	2930		
90% Chebyshev(Mean, Sd) UCL	2828	95% Chebyshev(Mean, Sd) UCL	3630
97.5% Chebyshev(Mean, Sd) UCL	4744	99% Chebyshev(Mean, Sd) UCL	6932

Suggested UCL to Use

95% H-UCL	1334

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	30
		Number of Missing Observations	0
Minimum	50	Mean	1506
Maximum	33000	Median	290
SD	5378	Std. Error of Mean	884.1
Coefficient of Variation	3.572	Skewness	5.888

Normal GOF Test

Shapiro Wilk Test Statistic	0.262	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.393	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2998	95% Adjusted-CLT UCL (Chen-1995)	3874
		95% Modified-t UCL (Johnson-1978)	3141

Gamma GOF Test

A-D Test Statistic	3.679	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.823	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.25	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.154	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.454	k star (bias corrected MLE)	0.436
Theta hat (MLE)	3313	Theta star (bias corrected MLE)	3456
nu hat (MLE)	33.63	nu star (bias corrected)	32.24
MLE Mean (bias corrected)	1506	MLE Sd (bias corrected)	2281
		Approximate Chi Square Value (0.05)	20.26
Adjusted Level of Significance	0.0431	Adjusted Chi Square Value	19.85

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2396	95% Adjusted Gamma UCL (use when n<50)	2446

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.919	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.141	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.144	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.912	Mean of logged Data	5.898
Maximum of Logged Data	10.4	SD of logged Data	1.374

Assuming Lognormal Distribution

95% H-UCL	1801	90% Chebyshev (MVUE) UCL	1659
95% Chebyshev (MVUE) UCL	2005	97.5% Chebyshev (MVUE) UCL	2485
99% Chebyshev (MVUE) UCL	3429		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2960	95% Jackknife UCL	2998
95% Standard Bootstrap UCL	2972	95% Bootstrap-t UCL	10205
95% Hall's Bootstrap UCL	8268	95% Percentile Bootstrap UCL	3261
95% BCA Bootstrap UCL	4252		
90% Chebyshev(Mean, Sd) UCL	4158	95% Chebyshev(Mean, Sd) UCL	5360
97.5% Chebyshev(Mean, Sd) UCL	7027	99% Chebyshev(Mean, Sd) UCL	10303

Suggested UCL to Use

95% H-UCL	1801

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(g,h,i)perylene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	33
		Number of Missing Observations	0
Minimum	20	Mean	554.7
Maximum	11000	Median	100
SD	1799	Std. Error of Mean	295.7
Coefficient of Variation	3.243	Skewness	5.742

Normal GOF Test

Shapiro Wilk Test Statistic	0.29	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.383	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1054	95% Adjusted-CLT UCL (Chen-1995)	1339
		95% Modified-t UCL (Johnson-1978)	1101

Gamma GOF Test

A-D Test Statistic	3.582	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.813	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.261	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.153	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.5	k star (bias corrected MLE)	0.477
Theta hat (MLE)	1110	Theta star (bias corrected MLE)	1162
nu hat (MLE)	36.98	nu star (bias corrected)	35.31
MLE Mean (bias corrected)	554.7	MLE Sd (bias corrected)	803
		Approximate Chi Square Value (0.05)	22.72
Adjusted Level of Significance	0.0431	Adjusted Chi Square Value	22.28

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	862.3	95% Adjusted Gamma UCL (use when n<50)	879.3

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.923	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.996	Mean of logged Data	5.047
Maximum of Logged Data	9.306	SD of logged Data	1.309

Assuming Lognormal Distribution

95% H-UCL	669.9	90% Chebyshev (MVUE) UCL	634.3
95% Chebyshev (MVUE) UCL	762.2	97.5% Chebyshev (MVUE) UCL	939.8
99% Chebyshev (MVUE) UCL	1289		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(g,h,i)perylene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	1041	95% Jackknife UCL	1054
95% Standard Bootstrap UCL	1029	95% Bootstrap-t UCL	2986
95% Hall's Bootstrap UCL	2751	95% Percentile Bootstrap UCL	1130
95% BCA Bootstrap UCL	1675		
90% Chebyshev(Mean, Sd) UCL	1442	95% Chebyshev(Mean, Sd) UCL	1844
97.5% Chebyshev(Mean, Sd) UCL	2402	99% Chebyshev(Mean, Sd) UCL	3497

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	1844

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	33
		Number of Missing Observations	0
Minimum	19	Mean	495.8
Maximum	9300	Median	98
SD	1526	Std. Error of Mean	250.8
Coefficient of Variation	3.077	Skewness	5.637

Normal GOF Test

Shapiro Wilk Test Statistic	0.31	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.377	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	919.2	95% Adjusted-CLT UCL (Chen-1995)	1157
		95% Modified-t UCL (Johnson-1978)	957.9

Gamma GOF Test

A-D Test Statistic	3.31	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.814	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.25	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.153	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.492	k star (bias corrected MLE)	0.47
Theta hat (MLE)	1007	Theta star (bias corrected MLE)	1054
nu hat (MLE)	36.42	nu star (bias corrected)	34.8
MLE Mean (bias corrected)	495.8	MLE Sd (bias corrected)	722.9
		Approximate Chi Square Value (0.05)	22.3
Adjusted Level of Significance	0.0431	Adjusted Chi Square Value	21.87

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	773.5	95% Adjusted Gamma UCL (use when n<50)	788.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.156	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.944	Mean of logged Data	4.912
Maximum of Logged Data	9.138	SD of logged Data	1.369

Assuming Lognormal Distribution

95% H-UCL	663.5	90% Chebyshev (MVUE) UCL	612.8
95% Chebyshev (MVUE) UCL	740.2	97.5% Chebyshev (MVUE) UCL	917.2
99% Chebyshev (MVUE) UCL	1265		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(k)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	908.3	95% Jackknife UCL	919.2
95% Standard Bootstrap UCL	893	95% Bootstrap-t UCL	2267
95% Hall's Bootstrap UCL	2374	95% Percentile Bootstrap UCL	975.9
95% BCA Bootstrap UCL	1309		
90% Chebyshev(Mean, Sd) UCL	1248	95% Chebyshev(Mean, Sd) UCL	1589
97.5% Chebyshev(Mean, Sd) UCL	2062	99% Chebyshev(Mean, Sd) UCL	2991

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	1589

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	33
		Number of Missing Observations	0
Minimum	38	Mean	1259
Maximum	29000	Median	190
SD	4732	Std. Error of Mean	778
Coefficient of Variation	3.758	Skewness	5.907

Normal GOF Test

Shapiro Wilk Test Statistic	0.254	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.4	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	2573	95% Adjusted-CLT UCL (Chen-1995)	3346
		95% Modified-t UCL (Johnson-1978)	2699

Gamma GOF Test

A-D Test Statistic	3.926	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.83	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.252	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.155	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.423	k star (bias corrected MLE)	0.406
Theta hat (MLE)	2980	Theta star (bias corrected MLE)	3099
nu hat (MLE)	31.27	nu star (bias corrected)	30.07
MLE Mean (bias corrected)	1259	MLE Sd (bias corrected)	1976
		Approximate Chi Square Value (0.05)	18.55
Adjusted Level of Significance	0.0431	Adjusted Chi Square Value	18.15

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2042	95% Adjusted Gamma UCL (use when n<50)	2086

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.915	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.139	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.144	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.638	Mean of logged Data	5.595
Maximum of Logged Data	10.28	SD of logged Data	1.419

Assuming Lognormal Distribution

95% H-UCL	1464	90% Chebyshev (MVUE) UCL	1321
95% Chebyshev (MVUE) UCL	1603	97.5% Chebyshev (MVUE) UCL	1994
99% Chebyshev (MVUE) UCL	2762		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chrysene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	2539	95% Jackknife UCL	2573
95% Standard Bootstrap UCL	2496	95% Bootstrap-t UCL	9516
95% Hall's Bootstrap UCL	7259	95% Percentile Bootstrap UCL	2764
95% BCA Bootstrap UCL	3651		
90% Chebyshev(Mean, Sd) UCL	3593	95% Chebyshev(Mean, Sd) UCL	4650
97.5% Chebyshev(Mean, Sd) UCL	6118	99% Chebyshev(Mean, Sd) UCL	9000

Suggested UCL to Use

95% H-UCL 1464

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	27
Number of Detects	21	Number of Non-Detects	16
Number of Distinct Detects	19	Number of Distinct Non-Detects	11
Minimum Detect	20	Minimum Non-Detect	8.6
Maximum Detect	3700	Maximum Non-Detect	40
Variance Detects	624269	Percent Non-Detects	43.24%
Mean Detects	294.1	SD Detects	790.1
Median Detects	71	CV Detects	2.687
Skewness Detects	4.405	Kurtosis Detects	19.82
Mean of Logged Detects	4.513	SD of Logged Detects	1.315

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.343	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.908	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.422	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.188	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	171.1	KM Standard Error of Mean	100.7
KM SD	597.7	95% KM (BCA) UCL	381
95% KM (t) UCL	341.1	95% KM (Percentile Bootstrap) UCL	369.5
95% KM (z) UCL	336.8	95% KM Bootstrap t UCL	1063
90% KM Chebyshev UCL	473.2	95% KM Chebyshev UCL	610.1
97.5% KM Chebyshev UCL	800	99% KM Chebyshev UCL	1173

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.972	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.802	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.259	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.2	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.537	k star (bias corrected MLE)	0.492
Theta hat (MLE)	547.8	Theta star (bias corrected MLE)	597.9
nu hat (MLE)	22.55	nu star (bias corrected)	20.66
Mean (detects)	294.1		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	166.9
Maximum	3700	Median	24
SD	607.1	CV	3.638
k hat (MLE)	0.166	k star (bias corrected MLE)	0.171
Theta hat (MLE)	1003	Theta star (bias corrected MLE)	976.3
nu hat (MLE)	12.32	nu star (bias corrected)	12.65
Adjusted Level of Significance (β)	0.0431		
Approximate Chi Square Value (12.65, α)	5.659	Adjusted Chi Square Value (12.65, β)	5.456
95% Gamma Approximate UCL (use when n>=50)	373.1	95% Gamma Adjusted UCL (use when n<50)	387

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	171.1	SD (KM)	597.7
Variance (KM)	357283	SE of Mean (KM)	100.7
k hat (KM)	0.082	k star (KM)	0.0934
nu hat (KM)	6.067	nu star (KM)	6.908
theta hat (KM)	2088	theta star (KM)	1833
80% gamma percentile (KM)	107	90% gamma percentile (KM)	441.8
95% gamma percentile (KM)	996.4	99% gamma percentile (KM)	2813

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (6.91, α)	2.12	Adjusted Chi Square Value (6.91, β)	2.007
95% Gamma Approximate KM-UCL (use when n>=50)	557.6	95% Gamma Adjusted KM-UCL (use when n<50)	589.1

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.892	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.908	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.188	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	168.9	Mean in Log Scale	3.172
SD in Original Scale	606.6	SD in Log Scale	1.871
95% t UCL (assumes normality of ROS data)	337.3	95% Percentile Bootstrap UCL	364.7
95% BCA Bootstrap UCL	464.4	95% Bootstrap t UCL	1069
95% H-UCL (Log ROS)	414.4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.527	KM Geo Mean	34.03
KM SD (logged)	1.498	95% Critical H Value (KM-Log)	3.016
KM Standard Error of Mean (logged)	0.254	95% H-UCL (KM -Log)	221.8
KM SD (logged)	1.498	95% Critical H Value (KM-Log)	3.016
KM Standard Error of Mean (logged)	0.254		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	171.1	Mean in Log Scale	3.517
SD in Original Scale	606	SD in Log Scale	1.538
95% t UCL (Assumes normality)	339.3	95% H-Stat UCL	241.7

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	221.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	30
		Number of Missing Observations	0
Minimum	68	Mean	2523
Maximum	59000	Median	380
SD	9635	Std. Error of Mean	1584
Coefficient of Variation	3.818	Skewness	5.906

Normal GOF Test

Shapiro Wilk Test Statistic	0.253	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.403	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5198	95% Adjusted-CLT UCL (Chen-1995)	6772
		95% Modified-t UCL (Johnson-1978)	5454

Gamma GOF Test

A-D Test Statistic	3.967	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.834	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.275	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.155	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.405	k star (bias corrected MLE)	0.39
Theta hat (MLE)	6228	Theta star (bias corrected MLE)	6465
nu hat (MLE)	29.98	nu star (bias corrected)	28.89
MLE Mean (bias corrected)	2523	MLE Sd (bias corrected)	4039
		Approximate Chi Square Value (0.05)	17.62
Adjusted Level of Significance	0.0431	Adjusted Chi Square Value	17.24

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4137	95% Adjusted Gamma UCL (use when n<50)	4229

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.918	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.148	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.22	Mean of logged Data	6.213
Maximum of Logged Data	10.99	SD of logged Data	1.46

Assuming Lognormal Distribution

95% H-UCL	2981	90% Chebyshev (MVUE) UCL	2637
95% Chebyshev (MVUE) UCL	3210	97.5% Chebyshev (MVUE) UCL	4005
99% Chebyshev (MVUE) UCL	5568		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	5129	95% Jackknife UCL	5198
95% Standard Bootstrap UCL	5119	95% Bootstrap-t UCL	19734
95% Hall's Bootstrap UCL	14343	95% Percentile Bootstrap UCL	5486
95% BCA Bootstrap UCL	8554		
90% Chebyshev(Mean, Sd) UCL	7275	95% Chebyshev(Mean, Sd) UCL	9428
97.5% Chebyshev(Mean, Sd) UCL	12415	99% Chebyshev(Mean, Sd) UCL	18284

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	9428

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluorene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	30
Number of Detects	26	Number of Non-Detects	11
Number of Distinct Detects	22	Number of Distinct Non-Detects	11
Minimum Detect	5.1	Minimum Non-Detect	5.2
Maximum Detect	3000	Maximum Non-Detect	16
Variance Detects	337799	Percent Non-Detects	29.73%
Mean Detects	174.2	SD Detects	581.2
Median Detects	29	CV Detects	3.337
Skewness Detects	4.966	Kurtosis Detects	25.03
Mean of Logged Detects	3.6	SD of Logged Detects	1.489

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.291	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.394	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	124.1	KM Standard Error of Mean	81.13
KM SD	483.9	95% KM (BCA) UCL	292.4
95% KM (t) UCL	261	95% KM (Percentile Bootstrap) UCL	281.8
95% KM (z) UCL	257.5	95% KM Bootstrap t UCL	1063
90% KM Chebyshev UCL	367.5	95% KM Chebyshev UCL	477.7
97.5% KM Chebyshev UCL	630.7	99% KM Chebyshev UCL	931.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.609	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.826	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.216	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.183	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.419	k star (bias corrected MLE)	0.396
Theta hat (MLE)	415.9	Theta star (bias corrected MLE)	439.7
nu hat (MLE)	21.78	nu star (bias corrected)	20.6
Mean (detects)	174.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	122.4
Maximum	3000	Median	15
SD	491	CV	4.012
k hat (MLE)	0.202	k star (bias corrected MLE)	0.203
Theta hat (MLE)	607.2	Theta star (bias corrected MLE)	602.2
nu hat (MLE)	14.92	nu star (bias corrected)	15.04
Adjusted Level of Significance (β)	0.0431		
Approximate Chi Square Value (15.04, α)	7.29	Adjusted Chi Square Value (15.04, β)	7.055
95% Gamma Approximate UCL (use when n>=50)	252.5	95% Gamma Adjusted UCL (use when n<50)	260.9

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Fluorene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	124.1	SD (KM)	483.9
Variance (KM)	234178	SE of Mean (KM)	81.13
k hat (KM)	0.0657	k star (KM)	0.0784
nu hat (KM)	4.864	nu star (KM)	5.803
theta hat (KM)	1887	theta star (KM)	1582
80% gamma percentile (KM)	56.77	90% gamma percentile (KM)	290.4
95% gamma percentile (KM)	720.7	99% gamma percentile (KM)	2218

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (5.80, α)	1.54	Adjusted Chi Square Value (5.80, β)	1.448
95% Gamma Approximate KM-UCL (use when n>=50)	467.5	95% Gamma Adjusted KM-UCL (use when n<50)	497.4

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.134	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	123.3	Mean in Log Scale	2.863
SD in Original Scale	490.8	SD in Log Scale	1.696
95% t UCL (assumes normality of ROS data)	259.5	95% Percentile Bootstrap UCL	280.9
95% BCA Bootstrap UCL	375.3	95% Bootstrap t UCL	1071
95% H-UCL (Log ROS)	187		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.037	KM Geo Mean	20.84
KM SD (logged)	1.503	95% Critical H Value (KM-Log)	3.023
KM Standard Error of Mean (logged)	0.253	95% H-UCL (KM -Log)	137.5
KM SD (logged)	1.503	95% Critical H Value (KM-Log)	3.023
KM Standard Error of Mean (logged)	0.253		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	123.7	Mean in Log Scale	2.951
SD in Original Scale	490.7	SD in Log Scale	1.61
95% t UCL (Assumes normality)	259.9	95% H-Stat UCL	163.8

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	137.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	34
Number of Detects	36	Number of Non-Detects	1
Number of Distinct Detects	33	Number of Distinct Non-Detects	1
Minimum Detect	20	Minimum Non-Detect	15
Maximum Detect	11000	Maximum Non-Detect	15
Variance Detects	3307896	Percent Non-Detects	2.703%
Mean Detects	544.6	SD Detects	1819
Median Detects	91.5	CV Detects	3.34
Skewness Detects	5.738	Kurtosis Detects	33.77
Mean of Logged Detects	4.997	SD of Logged Detects	1.318

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.28	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.935	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.387	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.145	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	530.3	KM Standard Error of Mean	295.3
KM SD	1771	95% KM (BCA) UCL	1137
95% KM (t) UCL	1029	95% KM (Percentile Bootstrap) UCL	1091
95% KM (z) UCL	1016	95% KM Bootstrap t UCL	3190
90% KM Chebyshev UCL	1416	95% KM Chebyshev UCL	1817
97.5% KM Chebyshev UCL	2374	99% KM Chebyshev UCL	3468

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	3.55	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.815	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.243	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.155	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.489	k star (bias corrected MLE)	0.467
Theta hat (MLE)	1114	Theta star (bias corrected MLE)	1167
nu hat (MLE)	35.21	nu star (bias corrected)	33.61
Mean (detects)	544.6		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	529.9
Maximum	11000	Median	88
SD	1796	CV	3.389
k hat (MLE)	0.424	k star (bias corrected MLE)	0.408
Theta hat (MLE)	1248	Theta star (bias corrected MLE)	1299
nu hat (MLE)	31.41	nu star (bias corrected)	30.2
Adjusted Level of Significance (β)	0.0431		
Approximate Chi Square Value (30.20, α)	18.65	Adjusted Chi Square Value (30.20, β)	18.25
95% Gamma Approximate UCL (use when n>=50)	858.1	95% Gamma Adjusted UCL (use when n<50)	876.6

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Indeno(1,2,3-cd)pyrene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	530.3	SD (KM)	1771
Variance (KM)	3136467	SE of Mean (KM)	295.3
k hat (KM)	0.0897	k star (KM)	0.1
nu hat (KM)	6.635	nu star (KM)	7.43
theta hat (KM)	5915	theta star (KM)	5281
80% gamma percentile (KM)	370.1	90% gamma percentile (KM)	1414
95% gamma percentile (KM)	3077	99% gamma percentile (KM)	8406

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (7.43, α)	2.41	Adjusted Chi Square Value (7.43, β)	2.287
95% Gamma Approximate KM-UCL (use when n>=50)	1635	95% Gamma Adjusted KM-UCL (use when n<50)	1723

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.935	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.159	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.145	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	530	Mean in Log Scale	4.909
SD in Original Scale	1796	SD in Log Scale	1.405
95% t UCL (assumes normality of ROS data)	1028	95% Percentile Bootstrap UCL	1101
95% BCA Bootstrap UCL	1465	95% Bootstrap t UCL	3202
95% H-UCL (Log ROS)	715.5		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.935	KM Geo Mean	139
KM SD (logged)	1.334	95% Critical H Value (KM-Log)	2.798
KM Standard Error of Mean (logged)	0.222	95% H-UCL (KM -Log)	630.9
KM SD (logged)	1.334	95% Critical H Value (KM-Log)	2.798
KM Standard Error of Mean (logged)	0.222		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	530.1	Mean in Log Scale	4.916
SD in Original Scale	1795	SD in Log Scale	1.389
95% t UCL (Assumes normality)	1028	95% H-Stat UCL	695.3

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1817

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	27	Mean	1479
Maximum	37000	Median	120
SD	6051	Std. Error of Mean	994.8
Coefficient of Variation	4.093	Skewness	5.932

Normal GOF Test

Shapiro Wilk Test Statistic	0.242	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.425	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3158	95% Adjusted-CLT UCL (Chen-1995)	4152
		95% Modified-t UCL (Johnson-1978)	3320

Gamma GOF Test

A-D Test Statistic	4.355	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.846	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.254	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.156	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.35	k star (bias corrected MLE)	0.339
Theta hat (MLE)	4226	Theta star (bias corrected MLE)	4355
nu hat (MLE)	25.89	nu star (bias corrected)	25.12
MLE Mean (bias corrected)	1479	MLE Sd (bias corrected)	2538
		Approximate Chi Square Value (0.05)	14.7
Adjusted Level of Significance	0.0431	Adjusted Chi Square Value	14.36

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	2526	95% Adjusted Gamma UCL (use when n<50)	2587

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.898	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.157	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.296	Mean of logged Data	5.376
Maximum of Logged Data	10.52	SD of logged Data	1.599

Assuming Lognormal Distribution

95% H-UCL	1802	90% Chebyshev (MVUE) UCL	1473
95% Chebyshev (MVUE) UCL	1812	97.5% Chebyshev (MVUE) UCL	2284
99% Chebyshev (MVUE) UCL	3210		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Phenanthrene (cont.'d0

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	3115	95% Jackknife UCL	3158
95% Standard Bootstrap UCL	3057	95% Bootstrap-t UCL	14061
95% Hall's Bootstrap UCL	9366	95% Percentile Bootstrap UCL	3381
95% BCA Bootstrap UCL	4660		
90% Chebyshev(Mean, Sd) UCL	4463	95% Chebyshev(Mean, Sd) UCL	5815
97.5% Chebyshev(Mean, Sd) UCL	7691	99% Chebyshev(Mean, Sd) UCL	11377

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	5815

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene

General Statistics

Total Number of Observations	37	Number of Distinct Observations	29
		Number of Missing Observations	0
Minimum	57	Mean	1875
Maximum	41000	Median	320
SD	6704	Std. Error of Mean	1102
Coefficient of Variation	3.576	Skewness	5.83

Normal GOF Test

Shapiro Wilk Test Statistic	0.27	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.393	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.144	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3735	95% Adjusted-CLT UCL (Chen-1995)	4816
		95% Modified-t UCL (Johnson-1978)	3911

Gamma GOF Test

A-D Test Statistic	3.685	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.828	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.26	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.155	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.431	k star (bias corrected MLE)	0.414
Theta hat (MLE)	4350	Theta star (bias corrected MLE)	4528
nu hat (MLE)	31.89	nu star (bias corrected)	30.64
MLE Mean (bias corrected)	1875	MLE Sd (bias corrected)	2914
		Approximate Chi Square Value (0.05)	18.99
Adjusted Level of Significance	0.0431	Adjusted Chi Square Value	18.59

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3024	95% Adjusted Gamma UCL (use when n<50)	3089

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.936	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.135	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.144	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.043	Mean of logged Data	6.027
Maximum of Logged Data	10.62	SD of logged Data	1.433

Assuming Lognormal Distribution

95% H-UCL	2330	90% Chebyshev (MVUE) UCL	2089
95% Chebyshev (MVUE) UCL	2537	97.5% Chebyshev (MVUE) UCL	3160
99% Chebyshev (MVUE) UCL	4382		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	3687	95% Jackknife UCL	3735
95% Standard Bootstrap UCL	3633	95% Bootstrap-t UCL	12982
95% Hall's Bootstrap UCL	10184	95% Percentile Bootstrap UCL	4013
95% BCA Bootstrap UCL	5547		
90% Chebyshev(Mean, Sd) UCL	5181	95% Chebyshev(Mean, Sd) UCL	6679
97.5% Chebyshev(Mean, Sd) UCL	8757	99% Chebyshev(Mean, Sd) UCL	12840

Suggested UCL to Use

95% H-UCL 2330

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

ProUCL computes and outputs H-statistic based UCLs for historical reasons only.
H-statistic often results in unstable (both high and low) values of UCL95 as shown in examples in the Technical Guide.
It is therefore recommended to avoid the use of H-statistic based 95% UCLs.
Use of nonparametric methods are preferred to compute UCL95 for skewed data sets which do not follow a gamma distribution.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	27	Number of Distinct Observations	17
		Number of Missing Observations	0
Minimum	3.1	Mean	11.89
Maximum	24	Median	11
SD	4.767	Std. Error of Mean	0.917
Coefficient of Variation	0.401	Skewness	0.953

Normal GOF Test

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.146	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	13.45	95% Adjusted-CLT UCL (Chen-1995)	13.58
		95% Modified-t UCL (Johnson-1978)	13.48

Gamma GOF Test

A-D Test Statistic	0.383	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.746	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.117	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.168	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.462	k star (bias corrected MLE)	5.769
Theta hat (MLE)	1.84	Theta star (bias corrected MLE)	2.061
nu hat (MLE)	349	nu star (bias corrected)	311.5
MLE Mean (bias corrected)	11.89	MLE Sd (bias corrected)	4.95
		Approximate Chi Square Value (0.05)	271.6
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	269.3

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	13.63	95% Adjusted Gamma UCL (use when n<50)	13.76

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.131	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.167	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.131	Mean of logged Data	2.396
Maximum of Logged Data	3.178	SD of logged Data	0.421

Assuming Lognormal Distribution

95% H-UCL	14.05	90% Chebyshev (MVUE) UCL	14.95
95% Chebyshev (MVUE) UCL	16.31	97.5% Chebyshev (MVUE) UCL	18.19
99% Chebyshev (MVUE) UCL	21.89		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	13.4	95% Jackknife UCL	13.45
95% Standard Bootstrap UCL	13.36	95% Bootstrap-t UCL	13.89
95% Hall's Bootstrap UCL	13.8	95% Percentile Bootstrap UCL	13.37
95% BCA Bootstrap UCL	13.56		
90% Chebyshev(Mean, Sd) UCL	14.64	95% Chebyshev(Mean, Sd) UCL	15.89
97.5% Chebyshev(Mean, Sd) UCL	17.62	99% Chebyshev(Mean, Sd) UCL	21.02

Suggested UCL to Use

95% Student's-t UCL	13.45

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium

General Statistics

Total Number of Observations	27	Number of Distinct Observations	24
		Number of Missing Observations	0
Minimum	0.059	Mean	0.408
Maximum	0.86	Median	0.43
SD	0.176	Std. Error of Mean	0.0339
Coefficient of Variation	0.431	Skewness	0.127

Normal GOF Test

Shapiro Wilk Test Statistic	0.977	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.0893	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.466	95% Adjusted-CLT UCL (Chen-1995)	0.465
		95% Modified-t UCL (Johnson-1978)	0.466

Gamma GOF Test

A-D Test Statistic	0.795	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.749	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.164	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.169	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.13	k star (bias corrected MLE)	3.696
Theta hat (MLE)	0.0989	Theta star (bias corrected MLE)	0.111
nu hat (MLE)	223	nu star (bias corrected)	199.6
MLE Mean (bias corrected)	0.408	MLE Sd (bias corrected)	0.212
		Approximate Chi Square Value (0.05)	167.9
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	166

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.486	95% Adjusted Gamma UCL (use when n<50)	0.491

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.868	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.201	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.167	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.83	Mean of logged Data	-1.021
Maximum of Logged Data	-0.151	SD of logged Data	0.579

Assuming Lognormal Distribution

95% H-UCL	0.537	90% Chebyshev (MVUE) UCL	0.572
95% Chebyshev (MVUE) UCL	0.64	97.5% Chebyshev (MVUE) UCL	0.734
99% Chebyshev (MVUE) UCL	0.918		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cadmium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.464	95% Jackknife UCL	0.466
95% Standard Bootstrap UCL	0.466	95% Bootstrap-t UCL	0.465
95% Hall's Bootstrap UCL	0.466	95% Percentile Bootstrap UCL	0.461
95% BCA Bootstrap UCL	0.466		
90% Chebyshev(Mean, Sd) UCL	0.51	95% Chebyshev(Mean, Sd) UCL	0.556
97.5% Chebyshev(Mean, Sd) UCL	0.62	99% Chebyshev(Mean, Sd) UCL	0.745

Suggested UCL to Use

95% Student's-t UCL	0.466

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium

General Statistics

Total Number of Observations	27	Number of Distinct Observations	14
		Number of Missing Observations	0
Minimum	3.7	Mean	14.09
Maximum	20	Median	15
SD	4.259	Std. Error of Mean	0.82
Coefficient of Variation	0.302	Skewness	-0.61

Normal GOF Test

Shapiro Wilk Test Statistic	0.952	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.103	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	15.49	95% Adjusted-CLT UCL (Chen-1995)	15.34
		95% Modified-t UCL (Johnson-1978)	15.47

Gamma GOF Test

A-D Test Statistic	0.756	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.745	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.136	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.168	Detected data appear Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.542	k star (bias corrected MLE)	7.618
Theta hat (MLE)	1.65	Theta star (bias corrected MLE)	1.85
nu hat (MLE)	461.3	nu star (bias corrected)	411.4
MLE Mean (bias corrected)	14.09	MLE Sd (bias corrected)	5.106
		Approximate Chi Square Value (0.05)	365.4
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	362.6

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	15.87	95% Adjusted Gamma UCL (use when n<50)	15.99

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.848	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.167	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.308	Mean of logged Data	2.586
Maximum of Logged Data	2.996	SD of logged Data	0.387

Assuming Lognormal Distribution

95% H-UCL	16.5	90% Chebyshev (MVUE) UCL	17.54
95% Chebyshev (MVUE) UCL	19.02	97.5% Chebyshev (MVUE) UCL	21.08
99% Chebyshev (MVUE) UCL	25.12		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	15.44	95% Jackknife UCL	15.49
95% Standard Bootstrap UCL	15.41	95% Bootstrap-t UCL	15.37
95% Hall's Bootstrap UCL	15.33	95% Percentile Bootstrap UCL	15.37
95% BCA Bootstrap UCL	15.31		
90% Chebyshev(Mean, Sd) UCL	16.55	95% Chebyshev(Mean, Sd) UCL	17.67
97.5% Chebyshev(Mean, Sd) UCL	19.21	99% Chebyshev(Mean, Sd) UCL	22.25

Suggested UCL to Use

95% Student's-t UCL	15.49

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper

General Statistics

Total Number of Observations	27	Number of Distinct Observations	21
		Number of Missing Observations	0
Minimum	2.9	Mean	23.3
Maximum	39	Median	24
SD	9.327	Std. Error of Mean	1.795
Coefficient of Variation	0.4	Skewness	-0.51

Normal GOF Test

Shapiro Wilk Test Statistic	0.967	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.117	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	26.36	95% Adjusted-CLT UCL (Chen-1995)	26.06
		95% Modified-t UCL (Johnson-1978)	26.33

Gamma GOF Test

A-D Test Statistic	1.112	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.749	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.185	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.169	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	4.106	k star (bias corrected MLE)	3.675
Theta hat (MLE)	5.673	Theta star (bias corrected MLE)	6.339
nu hat (MLE)	221.7	nu star (bias corrected)	198.4
MLE Mean (bias corrected)	23.3	MLE Sd (bias corrected)	12.15
		Approximate Chi Square Value (0.05)	166.8
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	165

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	27.71	95% Adjusted Gamma UCL (use when n<50)	28.02

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.807	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.205	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.167	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.065	Mean of logged Data	3.022
Maximum of Logged Data	3.664	SD of logged Data	0.601

Assuming Lognormal Distribution

95% H-UCL	31.36	90% Chebyshev (MVUE) UCL	33.37
95% Chebyshev (MVUE) UCL	37.44	97.5% Chebyshev (MVUE) UCL	43.08
99% Chebyshev (MVUE) UCL	54.16		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Copper (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	26.25	95% Jackknife UCL	26.36
95% Standard Bootstrap UCL	26.2	95% Bootstrap-t UCL	26.2
95% Hall's Bootstrap UCL	26.13	95% Percentile Bootstrap UCL	26.08
95% BCA Bootstrap UCL	26.03		
90% Chebyshev(Mean, Sd) UCL	28.68	95% Chebyshev(Mean, Sd) UCL	31.12
97.5% Chebyshev(Mean, Sd) UCL	34.51	99% Chebyshev(Mean, Sd) UCL	41.16

Suggested UCL to Use

95% Student's-t UCL	26.36

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead

General Statistics

Total Number of Observations	27	Number of Distinct Observations	24
		Number of Missing Observations	0
Minimum	3.2	Mean	36.22
Maximum	140	Median	35
SD	28.23	Std. Error of Mean	5.433
Coefficient of Variation	0.779	Skewness	2.247

Normal GOF Test

Shapiro Wilk Test Statistic	0.792	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.211	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	45.49	95% Adjusted-CLT UCL (Chen-1995)	47.67
		95% Modified-t UCL (Johnson-1978)	45.88

Gamma GOF Test

A-D Test Statistic	0.402	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.117	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.17	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.077	k star (bias corrected MLE)	1.871
Theta hat (MLE)	17.44	Theta star (bias corrected MLE)	19.36
nu hat (MLE)	112.2	nu star (bias corrected)	101
MLE Mean (bias corrected)	36.22	MLE Sd (bias corrected)	26.48
		Approximate Chi Square Value (0.05)	78.83
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	77.58

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	46.42	95% Adjusted Gamma UCL (use when n<50)	47.17

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.956	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.132	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.167	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.163	Mean of logged Data	3.33
Maximum of Logged Data	4.942	SD of logged Data	0.779

Assuming Lognormal Distribution

95% H-UCL	53.37	90% Chebyshev (MVUE) UCL	55.68
95% Chebyshev (MVUE) UCL	64	97.5% Chebyshev (MVUE) UCL	75.54
99% Chebyshev (MVUE) UCL	98.22		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Lead (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	45.16	95% Jackknife UCL	45.49
95% Standard Bootstrap UCL	45.29	95% Bootstrap-t UCL	49.49
95% Hall's Bootstrap UCL	93.73	95% Percentile Bootstrap UCL	45.48
95% BCA Bootstrap UCL	47.9		
90% Chebyshev(Mean, Sd) UCL	52.52	95% Chebyshev(Mean, Sd) UCL	59.91
97.5% Chebyshev(Mean, Sd) UCL	70.15	99% Chebyshev(Mean, Sd) UCL	90.28

Suggested UCL to Use

95% Adjusted Gamma UCL	47.17

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury

General Statistics

Total Number of Observations	27	Number of Distinct Observations	22
Number of Detects	20	Number of Non-Detects	7
Number of Distinct Detects	16	Number of Distinct Non-Detects	7
Minimum Detect	0.049	Minimum Non-Detect	0.021
Maximum Detect	0.17	Maximum Non-Detect	0.1
Variance Detects	8.0525E-4	Percent Non-Detects	25.93%
Mean Detects	0.0849	SD Detects	0.0284
Median Detects	0.085	CV Detects	0.334
Skewness Detects	1.289	Kurtosis Detects	2.952
Mean of Logged Detects	-2.515	SD of Logged Detects	0.315

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.905	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.147	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.192	Detected Data appear Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0707	KM Standard Error of Mean	0.00704
KM SD	0.035	95% KM (BCA) UCL	0.0822
95% KM (t) UCL	0.0827	95% KM (Percentile Bootstrap) UCL	0.0824
95% KM (z) UCL	0.0823	95% KM Bootstrap t UCL	0.0827
90% KM Chebyshev UCL	0.0919	95% KM Chebyshev UCL	0.101
97.5% KM Chebyshev UCL	0.115	99% KM Chebyshev UCL	0.141

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.467	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.742	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.114	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.194	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	10.52	k star (bias corrected MLE)	8.976
Theta hat (MLE)	0.00807	Theta star (bias corrected MLE)	0.00946
nu hat (MLE)	420.8	nu star (bias corrected)	359
Mean (detects)	0.0849		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.0324	Mean	0.0731
Maximum	0.17	Median	0.068
SD	0.0321	CV	0.439
k hat (MLE)	5.56	k star (bias corrected MLE)	4.967
Theta hat (MLE)	0.0131	Theta star (bias corrected MLE)	0.0147
nu hat (MLE)	300.2	nu star (bias corrected)	268.2
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (268.19, α)	231.3	Adjusted Chi Square Value (268.19, β)	229.1
95% Gamma Approximate UCL (use when n>=50)	0.0847	95% Gamma Adjusted UCL (use when n<50)	0.0855

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Mercury (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0707	SD (KM)	0.035
Variance (KM)	0.00122	SE of Mean (KM)	0.00704
k hat (KM)	4.092	k star (KM)	3.662
nu hat (KM)	221	nu star (KM)	197.7
theta hat (KM)	0.0173	theta star (KM)	0.0193
80% gamma percentile (KM)	0.0985	90% gamma percentile (KM)	0.12
95% gamma percentile (KM)	0.14	99% gamma percentile (KM)	0.184

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (197.73, α)	166.2	Adjusted Chi Square Value (197.73, β)	164.4
95% Gamma Approximate KM-UCL (use when n>=50)	0.0842	95% Gamma Adjusted KM-UCL (use when n<50)	0.0851

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.948	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.905	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.119	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.192	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0746	Mean in Log Scale	-2.669
SD in Original Scale	0.0303	SD in Log Scale	0.386
95% t UCL (assumes normality of ROS data)	0.0845	95% Percentile Bootstrap UCL	0.0843
95% BCA Bootstrap UCL	0.085	95% Bootstrap t UCL	0.086
95% H-UCL (Log ROS)	0.0861		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.801	KM Geo Mean	0.0607
KM SD (logged)	0.597	95% Critical H Value (KM-Log)	2.059
KM Standard Error of Mean (logged)	0.123	95% H-UCL (KM -Log)	0.0924
KM SD (logged)	0.597	95% Critical H Value (KM-Log)	2.059
KM Standard Error of Mean (logged)	0.123		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0692	Mean in Log Scale	-2.859
SD in Original Scale	0.0369	SD in Log Scale	0.705
95% t UCL (Assumes normality)	0.0813	95% H-Stat UCL	0.0992

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.0827

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Methyl mercury

General Statistics

Total Number of Observations	27	Number of Distinct Observations	21
Number of Detects	15	Number of Non-Detects	12
Number of Distinct Detects	13	Number of Distinct Non-Detects	9
Minimum Detect	1.4000E-4	Minimum Non-Detect	8.7000E-5
Maximum Detect	6.9000E-4	Maximum Non-Detect	4.2000E-4
Variance Detects	2.9798E-8	Percent Non-Detects	44.44%
Mean Detects	4.0133E-4	SD Detects	1.7262E-4
Median Detects	3.3000E-4	CV Detects	0.43
Skewness Detects	0.318	Kurtosis Detects	-1.26
Mean of Logged Detects	-7.915	SD of Logged Detects	0.461

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.92	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.194	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.22	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.67E-04	KM Standard Error of Mean	3.9415E-5
KM SD	1.9628E-4	95% KM (BCA) UCL	3.4333E-4
95% KM (t) UCL	3.3443E-4	95% KM (Percentile Bootstrap) UCL	3.3567E-4
95% KM (z) UCL	3.3203E-4	95% KM Bootstrap t UCL	3.4029E-4
90% KM Chebyshev UCL	3.8544E-4	95% KM Chebyshev UCL	4.3901E-4
97.5% KM Chebyshev UCL	5.1335E-4	99% KM Chebyshev UCL	6.5937E-4

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.515	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.738	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.166	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.222	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	5.492	k star (bias corrected MLE)	4.438
Theta hat (MLE)	7.3080E-5	Theta star (bias corrected MLE)	9.0435E-5
nu hat (MLE)	164.8	nu star (bias corrected)	133.1
Mean (detects)	4.0133E-4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	1.4000E-4	Mean	0.00467
Maximum	0.01	Median	6.5000E-4
SD	0.00486	CV	1.042
k hat (MLE)	0.577	k star (bias corrected MLE)	0.538
Theta hat (MLE)	0.00809	Theta star (bias corrected MLE)	0.00868
nu hat (MLE)	31.17	nu star (bias corrected)	29.04
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (29.04, α)	17.74	Adjusted Chi Square Value (29.04, β)	17.18
95% Gamma Approximate UCL (use when n>=50)	0.00764	95% Gamma Adjusted UCL (use when n<50)	0.00789

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Methyl mercury (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.6720E-4	SD (KM)	1.9628E-4
Variance (KM)	3.8527E-8	SE of Mean (KM)	3.9415E-5
k hat (KM)	1.853	k star (KM)	1.672
nu hat (KM)	100.1	nu star (KM)	90.28
theta hat (KM)	1.4419E-4	theta star (KM)	1.5982E-4
80% gamma percentile (KM)	4.0844E-4	90% gamma percentile (KM)	5.4233E-4
95% gamma percentile (KM)	6.7146E-4	99% gamma percentile (KM)	9.6102E-4

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (90.28, α)	69.38	Adjusted Chi Square Value (90.28, β)	68.2
95% Gamma Approximate KM-UCL (use when n>=50)	3.4773E-4	95% Gamma Adjusted KM-UCL (use when n<50)	3.5371E-4

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.881	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.158	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.22	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	2.7987E-4	Mean in Log Scale	-8.388
SD in Original Scale	1.8827E-4	SD in Log Scale	0.648
95% t UCL (assumes normality of ROS data)	3.4167E-4	95% Percentile Bootstrap UCL	3.3834E-4
95% BCA Bootstrap UCL	3.4801E-4	95% Bootstrap t UCL	3.5128E-4
95% H-UCL (Log ROS)	3.6725E-4		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-8.51	KM Geo Mean	2.0149E-4
KM SD (logged)	0.762	95% Critical H Value (KM-Log)	2.229
KM Standard Error of Mean (logged)	0.156	95% H-UCL (KM -Log)	3.7567E-4
KM SD (logged)	0.762	95% Critical H Value (KM-Log)	2.229
KM Standard Error of Mean (logged)	0.156		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	2.6563E-4	Mean in Log Scale	-8.545
SD in Original Scale	2.0182E-4	SD in Log Scale	0.839
95% t UCL (Assumes normality)	3.3188E-4	95% H-Stat UCL	4.0534E-4

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	3.34E-04

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel

General Statistics

Total Number of Observations	27	Number of Distinct Observations	16
		Number of Missing Observations	0
Minimum	4.1	Mean	16.34
Maximum	26	Median	17
SD	5.269	Std. Error of Mean	1.014
Coefficient of Variation	0.322	Skewness	-0.539

Normal GOF Test

Shapiro Wilk Test Statistic	0.962	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.142	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	18.07	95% Adjusted-CLT UCL (Chen-1995)	17.9
		95% Modified-t UCL (Johnson-1978)	18.05

Gamma GOF Test

A-D Test Statistic	0.987	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.746	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.184	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.168	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.372	k star (bias corrected MLE)	6.578
Theta hat (MLE)	2.216	Theta star (bias corrected MLE)	2.484
nu hat (MLE)	398.1	nu star (bias corrected)	355.2
MLE Mean (bias corrected)	16.34	MLE Sd (bias corrected)	6.371
		Approximate Chi Square Value (0.05)	312.5
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	310

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	18.57	95% Adjusted Gamma UCL (use when n<50)	18.73

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.847	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.195	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.167	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.411	Mean of logged Data	2.724
Maximum of Logged Data	3.258	SD of logged Data	0.42

Assuming Lognormal Distribution

95% H-UCL	19.48	90% Chebyshev (MVUE) UCL	20.73
95% Chebyshev (MVUE) UCL	22.61	97.5% Chebyshev (MVUE) UCL	25.22
99% Chebyshev (MVUE) UCL	30.33		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Nickel (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	18.01	95% Jackknife UCL	18.07
95% Standard Bootstrap UCL	18.01	95% Bootstrap-t UCL	18.06
95% Hall's Bootstrap UCL	17.9	95% Percentile Bootstrap UCL	18
95% BCA Bootstrap UCL	17.89		
90% Chebyshev(Mean, Sd) UCL	19.38	95% Chebyshev(Mean, Sd) UCL	20.76
97.5% Chebyshev(Mean, Sd) UCL	22.67	99% Chebyshev(Mean, Sd) UCL	26.43

Suggested UCL to Use

95% Student's-t UCL	18.07

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Selenium

General Statistics

Total Number of Observations	27	Number of Distinct Observations	21
Number of Detects	26	Number of Non-Detects	1
Number of Distinct Detects	20	Number of Distinct Non-Detects	1
Minimum Detect	0.14	Minimum Non-Detect	0.12
Maximum Detect	1.8	Maximum Non-Detect	0.12
Variance Detects	0.151	Percent Non-Detects	3.704%
Mean Detects	0.868	SD Detects	0.388
Median Detects	0.855	CV Detects	0.447
Skewness Detects	0.294	Kurtosis Detects	0.351
Mean of Logged Detects	-0.268	SD of Logged Detects	0.569

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.972	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.92	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.119	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.17	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.84	KM Standard Error of Mean	0.0783
KM SD	0.399	95% KM (BCA) UCL	0.976
95% KM (t) UCL	0.974	95% KM (Percentile Bootstrap) UCL	0.968
95% KM (z) UCL	0.969	95% KM Bootstrap t UCL	0.975
90% KM Chebyshev UCL	1.075	95% KM Chebyshev UCL	1.182
97.5% KM Chebyshev UCL	1.329	99% KM Chebyshev UCL	1.62

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.548	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.141	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.172	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.12	k star (bias corrected MLE)	3.67
Theta hat (MLE)	0.211	Theta star (bias corrected MLE)	0.236
nu hat (MLE)	214.2	nu star (bias corrected)	190.8
Mean (detects)	0.868		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.14	Mean	0.843
Maximum	1.8	Median	0.82
SD	0.402	CV	0.477
k hat (MLE)	3.553	k star (bias corrected MLE)	3.183
Theta hat (MLE)	0.237	Theta star (bias corrected MLE)	0.265
nu hat (MLE)	191.9	nu star (bias corrected)	171.9
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (171.88, α)	142.6	Adjusted Chi Square Value (171.88, β)	140.9
95% Gamma Approximate UCL (use when n>=50)	1.016	95% Gamma Adjusted UCL (use when n<50)	1.029

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Selenium (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.84	SD (KM)	0.399
Variance (KM)	0.159	SE of Mean (KM)	0.0783
k hat (KM)	4.427	k star (KM)	3.96
nu hat (KM)	239.1	nu star (KM)	213.8
theta hat (KM)	0.19	theta star (KM)	0.212
80% gamma percentile (KM)	1.16	90% gamma percentile (KM)	1.406
95% gamma percentile (KM)	1.633	99% gamma percentile (KM)	2.117

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (213.85, α)	181	Adjusted Chi Square Value (213.85, β)	179.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.992	95% Gamma Adjusted KM-UCL (use when n<50)	1.003

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.9	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.92	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.179	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.17	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.843	Mean in Log Scale	-0.317
SD in Original Scale	0.402	SD in Log Scale	0.614
95% t UCL (assumes normality of ROS data)	0.975	95% Percentile Bootstrap UCL	0.965
95% BCA Bootstrap UCL	0.973	95% Bootstrap t UCL	0.98
95% H-UCL (Log ROS)	1.128		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.337	KM Geo Mean	0.714
KM SD (logged)	0.65	95% Critical H Value (KM-Log)	2.11
KM Standard Error of Mean (logged)	0.127	95% H-UCL (KM -Log)	1.154
KM SD (logged)	0.65	95% Critical H Value (KM-Log)	2.11
KM Standard Error of Mean (logged)	0.127		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.838	Mean in Log Scale	-0.362
SD in Original Scale	0.411	SD in Log Scale	0.742
95% t UCL (Assumes normality)	0.973	95% H-Stat UCL	1.264

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.974

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Silver

General Statistics

Total Number of Observations	27	Number of Distinct Observations	20
Number of Detects	22	Number of Non-Detects	5
Number of Distinct Detects	17	Number of Distinct Non-Detects	5
Minimum Detect	0.049	Minimum Non-Detect	0.022
Maximum Detect	0.35	Maximum Non-Detect	0.12
Variance Detects	0.00428	Percent Non-Detects	18.52%
Mean Detects	0.108	SD Detects	0.0654
Median Detects	0.0925	CV Detects	0.607
Skewness Detects	2.79	Kurtosis Detects	9.139
Mean of Logged Detects	-2.341	SD of Logged Detects	0.449

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.685	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.911	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.276	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.184	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.0943	KM Standard Error of Mean	0.0129
KM SD	0.065	95% KM (BCA) UCL	0.117
95% KM (t) UCL	0.116	95% KM (Percentile Bootstrap) UCL	0.117
95% KM (z) UCL	0.116	95% KM Bootstrap t UCL	0.127
90% KM Chebyshev UCL	0.133	95% KM Chebyshev UCL	0.15
97.5% KM Chebyshev UCL	0.175	99% KM Chebyshev UCL	0.222

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.956	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.747	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.194	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.186	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	4.559	k star (bias corrected MLE)	3.967
Theta hat (MLE)	0.0236	Theta star (bias corrected MLE)	0.0272
nu hat (MLE)	200.6	nu star (bias corrected)	174.6
Mean (detects)	0.108		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	0.0921
Maximum	0.35	Median	0.08
SD	0.0683	CV	0.741
k hat (MLE)	1.969	k star (bias corrected MLE)	1.775
Theta hat (MLE)	0.0468	Theta star (bias corrected MLE)	0.0519
nu hat (MLE)	106.3	nu star (bias corrected)	95.84
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (95.84, α)	74.26	Adjusted Chi Square Value (95.84, β)	73.05
95% Gamma Approximate UCL (use when n>=50)	0.119	95% Gamma Adjusted UCL (use when n<50)	0.121

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Silver (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.0943	SD (KM)	0.065
Variance (KM)	0.00422	SE of Mean (KM)	0.0129
k hat (KM)	2.109	k star (KM)	1.9
nu hat (KM)	113.9	nu star (KM)	102.6
theta hat (KM)	0.0447	theta star (KM)	0.0497
80% gamma percentile (KM)	0.142	90% gamma percentile (KM)	0.186
95% gamma percentile (KM)	0.227	99% gamma percentile (KM)	0.32

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (102.58, α)	80.21	Adjusted Chi Square Value (102.58, β)	78.94
95% Gamma Approximate KM-UCL (use when n>=50)	0.121	95% Gamma Adjusted KM-UCL (use when n<50)	0.123

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.916	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.911	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.16	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.184	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.096	Mean in Log Scale	-2.492
SD in Original Scale	0.0642	SD in Log Scale	0.529
95% t UCL (assumes normality of ROS data)	0.117	95% Percentile Bootstrap UCL	0.118
95% BCA Bootstrap UCL	0.123	95% Bootstrap t UCL	0.135
95% H-UCL (Log ROS)	0.117		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-2.556	KM Geo Mean	0.0776
KM SD (logged)	0.638	95% Critical H Value (KM-Log)	2.099
KM Standard Error of Mean (logged)	0.13	95% H-UCL (KM -Log)	0.124
KM SD (logged)	0.638	95% Critical H Value (KM-Log)	2.099
KM Standard Error of Mean (logged)	0.13		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.0929	Mean in Log Scale	-2.608
SD in Original Scale	0.0672	SD in Log Scale	0.749
95% t UCL (Assumes normality)	0.115	95% H-Stat UCL	0.135

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM Student's t	0.101	KM H-UCL	0.124

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc

General Statistics

Total Number of Observations	27	Number of Distinct Observations	23
		Number of Missing Observations	0
Minimum	13	Mean	99.3
Maximum	390	Median	89
SD	68.8	Std. Error of Mean	13.24
Coefficient of Variation	0.693	Skewness	2.982

Normal GOF Test

Shapiro Wilk Test Statistic	0.723	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.197	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.167	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	121.9	95% Adjusted-CLT UCL (Chen-1995)	129.2
		95% Modified-t UCL (Johnson-1978)	123.1

Gamma GOF Test

A-D Test Statistic	0.654	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.114	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.17	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.901	k star (bias corrected MLE)	2.604
Theta hat (MLE)	34.22	Theta star (bias corrected MLE)	38.14
nu hat (MLE)	156.7	nu star (bias corrected)	140.6
MLE Mean (bias corrected)	99.3	MLE Sd (bias corrected)	61.54
		Approximate Chi Square Value (0.05)	114.2
Adjusted Level of Significance	0.0401	Adjusted Chi Square Value	112.7

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	122.3	95% Adjusted Gamma UCL (use when n<50)	123.9

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.927	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.923	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.14	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.167	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	2.565	Mean of logged Data	4.416
Maximum of Logged Data	5.966	SD of logged Data	0.639

Assuming Lognormal Distribution

95% H-UCL	132	90% Chebyshev (MVUE) UCL	140.1
95% Chebyshev (MVUE) UCL	158.1	97.5% Chebyshev (MVUE) UCL	182.9
99% Chebyshev (MVUE) UCL	231.8		

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Zinc (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	121.1	95% Jackknife UCL	121.9
95% Standard Bootstrap UCL	120.1	95% Bootstrap-t UCL	136.2
95% Hall's Bootstrap UCL	226.6	95% Percentile Bootstrap UCL	122.6
95% BCA Bootstrap UCL	129.5		
90% Chebyshev(Mean, Sd) UCL	139	95% Chebyshev(Mean, Sd) UCL	157
97.5% Chebyshev(Mean, Sd) UCL	182	99% Chebyshev(Mean, Sd) UCL	231

Suggested UCL to Use

95% Adjusted Gamma UCL	123.9

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242)

General Statistics

Total Number of Observations	27	Number of Distinct Observations	24
Number of Detects	10	Number of Non-Detects	17
Number of Distinct Detects	9	Number of Distinct Non-Detects	17
Minimum Detect	43	Minimum Non-Detect	23
Maximum Detect	130	Maximum Non-Detect	100
Variance Detects	588.8	Percent Non-Detects	62.96%
Mean Detects	72.8	SD Detects	24.27
Median Detects	66	CV Detects	0.333
Skewness Detects	1.495	Kurtosis Detects	3.045
Mean of Logged Detects	4.244	SD of Logged Detects	0.305

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.877	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.187	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.262	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	44.1	KM Standard Error of Mean	5.908
KM SD	27.58	95% KM (BCA) UCL	56.44
95% KM (t) UCL	54.17	95% KM (Percentile Bootstrap) UCL	53.99
95% KM (z) UCL	53.81	95% KM Bootstrap t UCL	54.85
90% KM Chebyshev UCL	61.82	95% KM Chebyshev UCL	69.85
97.5% KM Chebyshev UCL	80.99	99% KM Chebyshev UCL	102.9

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.333	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.725	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.186	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.267	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	11.56	k star (bias corrected MLE)	8.157
Theta hat (MLE)	6.299	Theta star (bias corrected MLE)	8.925
nu hat (MLE)	231.1	nu star (bias corrected)	163.1
Mean (detects)	72.8		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	17.69	Mean	41.03
Maximum	130	Median	28.91
SD	28.98	CV	0.706
k hat (MLE)	2.613	k star (bias corrected MLE)	2.347
Theta hat (MLE)	15.7	Theta star (bias corrected MLE)	17.48
nu hat (MLE)	141.1	nu star (bias corrected)	126.8
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (126.76, α)	101.8	Adjusted Chi Square Value (126.76, β)	100.3
95% Gamma Approximate UCL (use when n>=50)	51.12	95% Gamma Adjusted UCL (use when n<50)	51.85

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1242 (PCB-1242) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	44.1	SD (KM)	27.58
Variance (KM)	760.6	SE of Mean (KM)	5.908
k hat (KM)	2.557	k star (KM)	2.297
nu hat (KM)	138.1	nu star (KM)	124
theta hat (KM)	17.25	theta star (KM)	19.2
80% gamma percentile (KM)	64.94	90% gamma percentile (KM)	83.04
95% gamma percentile (KM)	100.2	99% gamma percentile (KM)	137.9

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (124.05, α)	99.32	Adjusted Chi Square Value (124.05, β)	97.91
95% Gamma Approximate KM-UCL (use when n>=50)	55.07	95% Gamma Adjusted KM-UCL (use when n<50)	55.87

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.96	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.842	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.169	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.262	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	48.14	Mean in Log Scale	3.783
SD in Original Scale	24.12	SD in Log Scale	0.409
95% t UCL (assumes normality of ROS data)	56.06	95% Percentile Bootstrap UCL	56.28
95% BCA Bootstrap UCL	57.27	95% Bootstrap t UCL	58.91
95% H-UCL (Log ROS)	55.63		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.618	KM Geo Mean	37.26
KM SD (logged)	0.562	95% Critical H Value (KM-Log)	2.026
KM Standard Error of Mean (logged)	0.125	95% H-UCL (KM -Log)	54.53
KM SD (logged)	0.562	95% Critical H Value (KM-Log)	2.026
KM Standard Error of Mean (logged)	0.125		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	42.67	Mean in Log Scale	3.549
SD in Original Scale	28.65	SD in Log Scale	0.653
95% t UCL (Assumes normality)	52.07	95% H-Stat UCL	56.46

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	54.17

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	27	Number of Distinct Observations	23
Number of Detects	4	Number of Non-Detects	23
Number of Distinct Detects	4	Number of Distinct Non-Detects	19
Minimum Detect	69	Minimum Non-Detect	28
Maximum Detect	420	Maximum Non-Detect	130
Variance Detects	29943	Percent Non-Detects	85.19%
Mean Detects	160.5	SD Detects	173
Median Detects	76.5	CV Detects	1.078
Skewness Detects	1.997	Kurtosis Detects	3.991
Mean of Logged Detects	4.737	SD of Logged Detects	0.87

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.65	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.433	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.375	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	49.01	KM Standard Error of Mean	16.66
KM SD	74.49	95% KM (BCA) UCL	N/A
95% KM (t) UCL	77.42	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	76.41	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	98.98	95% KM Chebyshev UCL	121.6
97.5% KM Chebyshev UCL	153	99% KM Chebyshev UCL	214.8

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.866	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.662	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.456	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.399	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.612	k star (bias corrected MLE)	0.57
Theta hat (MLE)	99.56	Theta star (bias corrected MLE)	281.7
nu hat (MLE)	12.9	nu star (bias corrected)	4.558
Mean (detects)	160.5		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	23.79
Maximum	420	Median	0.01
SD	82.65	CV	3.475
k hat (MLE)	0.124	k star (bias corrected MLE)	0.135
Theta hat (MLE)	192.4	Theta star (bias corrected MLE)	176.8
nu hat (MLE)	6.675	nu star (bias corrected)	7.266
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (7.27, α)	2.318	Adjusted Chi Square Value (7.27, β)	2.143
95% Gamma Approximate UCL (use when n>=50)	74.57	95% Gamma Adjusted UCL (use when n<50)	N/A

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	49.01	SD (KM)	74.49
Variance (KM)	5548	SE of Mean (KM)	16.66
k hat (KM)	0.433	k star (KM)	0.409
nu hat (KM)	23.38	nu star (KM)	22.11
theta hat (KM)	113.2	theta star (KM)	119.7
80% gamma percentile (KM)	79.3	90% gamma percentile (KM)	137.8
95% gamma percentile (KM)	202	99% gamma percentile (KM)	362.8

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (22.11, α)	12.42	Adjusted Chi Square Value (22.11, β)	11.96
95% Gamma Approximate KM-UCL (use when n>=50)	87.23	95% Gamma Adjusted KM-UCL (use when n<50)	90.62

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.685	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.748	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.419	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.375	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	29.02	Mean in Log Scale	2.183
SD in Original Scale	81.13	SD in Log Scale	1.188
95% t UCL (assumes normality of ROS data)	55.65	95% Percentile Bootstrap UCL	57.94
95% BCA Bootstrap UCL	74.9	95% Bootstrap t UCL	149
95% H-UCL (Log ROS)	34.33		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.57	KM Geo Mean	35.51
KM SD (logged)	0.59	95% Critical H Value (KM-Log)	2.052
KM Standard Error of Mean (logged)	0.137	95% H-UCL (KM -Log)	53.59
KM SD (logged)	0.59	95% Critical H Value (KM-Log)	2.052
KM Standard Error of Mean (logged)	0.137		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	50.44	Mean in Log Scale	3.584
SD in Original Scale	75.82	SD in Log Scale	0.66
95% t UCL (Assumes normality)	75.33	95% H-Stat UCL	58.96

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	121.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

alpha-Chlordane

General Statistics

Total Number of Observations	27	Number of Distinct Observations	22
Number of Detects	1	Number of Non-Detects	26
Number of Distinct Detects	1	Number of Distinct Non-Detects	21

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable alpha-Chlordane was not processed!

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

gamma-Chlordane

General Statistics

Total Number of Observations	27	Number of Distinct Observations	20
Number of Detects	5	Number of Non-Detects	22
Number of Distinct Detects	5	Number of Distinct Non-Detects	17
Minimum Detect	2.3	Minimum Non-Detect	1.5
Maximum Detect	12	Maximum Non-Detect	40
Variance Detects	14.52	Percent Non-Detects	81.48%
Mean Detects	5.4	SD Detects	3.811
Median Detects	4.5	CV Detects	0.706
Skewness Detects	1.881	Kurtosis Detects	3.88
Mean of Logged Detects	1.524	SD of Logged Detects	0.607

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.781	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.373	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.343	Detected Data Not Normal at 5% Significance Level

Detected Data appear Approximate Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	2.498	KM Standard Error of Mean	0.527
KM SD	2.199	95% KM (BCA) UCL	3.804
95% KM (t) UCL	3.397	95% KM (Percentile Bootstrap) UCL	3.491
95% KM (z) UCL	3.365	95% KM Bootstrap t UCL	3.349
90% KM Chebyshev UCL	4.08	95% KM Chebyshev UCL	4.797
97.5% KM Chebyshev UCL	5.791	99% KM Chebyshev UCL	7.745

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.44	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.682	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.322	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.359	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.244	k star (bias corrected MLE)	1.431
Theta hat (MLE)	1.664	Theta star (bias corrected MLE)	3.773
nu hat (MLE)	32.44	nu star (bias corrected)	14.31
Mean (detects)	5.4		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	1.019
Maximum	12	Median	0.01
SD	2.601	CV	2.552
k hat (MLE)	0.216	k star (bias corrected MLE)	0.217
Theta hat (MLE)	4.714	Theta star (bias corrected MLE)	4.699
nu hat (MLE)	11.68	nu star (bias corrected)	11.71
Adjusted Level of Significance (β)	0.0401		
Approximate Chi Square Value (11.71, α)	5.038	Adjusted Chi Square Value (11.71, β)	4.76
95% Gamma Approximate UCL (use when n>=50)	2.369	95% Gamma Adjusted UCL (use when n<50)	2.508

Table B.24.2

Summary of ProUCL Output for Quarry Pond Sediments Bioaccumulation to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.111/19/2019 3:10:09 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

gamma-Chlordane (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	2.498	SD (KM)	2.199
Variance (KM)	4.837	SE of Mean (KM)	0.527
k hat (KM)	1.29	k star (KM)	1.171
nu hat (KM)	69.66	nu star (KM)	63.26
theta hat (KM)	1.936	theta star (KM)	2.132
80% gamma percentile (KM)	3.964	90% gamma percentile (KM)	5.531
95% gamma percentile (KM)	7.079	99% gamma percentile (KM)	10.63

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (63.26, α)	45.96	Adjusted Chi Square Value (63.26, β)	45.02
95% Gamma Approximate KM-UCL (use when n>=50)	3.438	95% Gamma Adjusted KM-UCL (use when n<50)	3.51

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.926	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.762	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.285	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.343	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	1.799	Mean in Log Scale	0.226
SD in Original Scale	2.318	SD in Log Scale	0.735
95% t UCL (assumes normality of ROS data)	2.56	95% Percentile Bootstrap UCL	2.584
95% BCA Bootstrap UCL	3.013	95% Bootstrap t UCL	3.82
95% H-UCL (Log ROS)	2.255		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	0.73	KM Geo Mean	2.075
KM SD (logged)	0.518	95% Critical H Value (KM-Log)	1.986
KM Standard Error of Mean (logged)	0.143	95% H-UCL (KM -Log)	2.902
KM SD (logged)	0.518	95% Critical H Value (KM-Log)	1.986
KM Standard Error of Mean (logged)	0.143		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	3.593	Mean in Log Scale	0.869
SD in Original Scale	4.367	SD in Log Scale	0.82
95% t UCL (Assumes normality)	5.026	95% H-Stat UCL	4.828

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Approximate Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	3.397

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.25.1

Summary of ProUCL Input Data for Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

			0	1	2	3	4	5
EU:	**Sample Location:**	**Sample Date:**	Arsenic	D_Arsenic	Manganese	D_Manganese	Thallium	D_Thallium
Quarry Pond	SW-1	9/18/2018	2.1	1	7.4	1	0.2	0
Quarry Pond	SW-1	9/18/2018	13	1	2000	1	0.2	0
Quarry Pond	SW-2	9/19/2018	1.8	1	5.2	1	0.2	0
Quarry Pond	SW-2	9/19/2018	14	1	1800	1	0.2	0
Quarry Pond	SW-3	9/20/2018	1.8	1	4.8	1	0.2	0
Quarry Pond	SW-3	9/20/2018	2	1	17	1	0.2	0
Quarry Pond	SW-4	9/19/2018	1.8	1	7.6	1	0.2	0
Quarry Pond	SW-5	9/19/2018	2	1	7.4	1	0.2	0
Quarry Pond	SW-6	9/19/2018	1.9	1	7.7	1	0.2	0
Quarry Pond	SW-7	9/20/2018	1.8	1	5.2	1	0.2	0
Quarry Pond	SW-7	9/20/2018	2	1	18	1	0.2	0
Quarry Pond	SW-8	9/19/2018	1.9	1	4.4	1	0.2	0
Quarry Pond	SW-8	9/19/2018	2.2	1	16	1	0.2	0
Quarry Pond	SW-9	9/19/2018	2	1	5.5	1	0.2	0
Quarry Pond	SW-10	9/18/2018	1.8	1	7.4	1	0.2	0
Quarry Pond	SW-1	10/2/2019	1.9	1	4.1	1	0.55	1
Quarry Pond	SW-1	10/2/2019	2.7	1	50	1	0.23	1
Quarry Pond	SW-2	10/2/2019	2	1	3.6	1	0.2	0
Quarry Pond	SW-2	10/2/2019	5.8	1	3000	1	0.2	0
Quarry Pond	SW-3	10/2/2019	1.7	1	4.4	1	0.2	0
Quarry Pond	SW-3	10/2/2019	2.1	1	20	1	0.2	0
Quarry Pond	SW-4	10/3/2019	1.75	1	4.9	1	0.2	0
Quarry Pond	SW-5	10/3/2019	1.7	1	5.8	1	0.2	0
Quarry Pond	SW-6	10/3/2019	1.8	1	3.7	1	0.2	0
Quarry Pond	SW-7	10/3/2019	1.8	1	6.8	1	0.2	0
Quarry Pond	SW-7	10/3/2019	2	1	36	1	0.2	0
Quarry Pond	SW-8	10/3/2019	2	1	3.7	1	0.2	0
Quarry Pond	SW-8	10/3/2019	2	1	7.8	1	0.2	0
Quarry Pond	SW-9	10/2/2019	1.8	1	3.9	1	0.2	0
Quarry Pond	SW-10	10/2/2019	1.7	1	5.25	1	0.2	0
Quarry Pond	SW-11	10/3/2019	1.6	1	5	1	0.2	0
Quarry Pond	SW-12	10/3/2019	1.7	1	5.4	1	0.2	0

Table B.25.2

Summary of ProUCL Output for Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	32	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	1.6	Mean	2.763
Maximum	14	Median	1.9
SD	2.908	Std. Error of Mean	0.514
Coefficient of Variation	1.053	Skewness	3.497

Normal GOF Test

Shapiro Wilk Test Statistic	0.379	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.452	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.634	95% Adjusted-CLT UCL (Chen-1995)	3.948
		95% Modified-t UCL (Johnson-1978)	3.687

Gamma GOF Test

A-D Test Statistic	7.739	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.427	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.157	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.499	k star (bias corrected MLE)	2.285
Theta hat (MLE)	1.106	Theta star (bias corrected MLE)	1.209
nu hat (MLE)	159.9	nu star (bias corrected)	146.3
MLE Mean (bias corrected)	2.763	MLE Sd (bias corrected)	1.827
		Approximate Chi Square Value (0.05)	119.3
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	118

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3.387	95% Adjusted Gamma UCL (use when n<50)	3.424

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.497	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.39	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.47	Mean of logged Data	0.803
Maximum of Logged Data	2.639	SD of logged Data	0.52

Assuming Lognormal Distribution

95% H-UCL	3.065	90% Chebyshev (MVUE) UCL	3.278
95% Chebyshev (MVUE) UCL	3.611	97.5% Chebyshev (MVUE) UCL	4.073
99% Chebyshev (MVUE) UCL	4.981		

Table B.25.2

Summary of ProUCL Output for Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	3.608	95% Jackknife UCL	3.634
95% Standard Bootstrap UCL	3.585	95% Bootstrap-t UCL	5.862
95% Hall's Bootstrap UCL	6.513	95% Percentile Bootstrap UCL	3.669
95% BCA Bootstrap UCL	4.066		
90% Chebyshev(Mean, Sd) UCL	4.305	95% Chebyshev(Mean, Sd) UCL	5.004
97.5% Chebyshev(Mean, Sd) UCL	5.973	99% Chebyshev(Mean, Sd) UCL	7.878

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	5.004

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.25.2

Summary of ProUCL Output for Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	32	Number of Distinct Observations	26
		Number of Missing Observations	0
Minimum	3.6	Mean	221.4
Maximum	3000	Median	6.3
SD	688.1	Std. Error of Mean	121.6
Coefficient of Variation	3.108	Skewness	3.246

Normal GOF Test

Shapiro Wilk Test Statistic	0.36	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.505	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	427.6	95% Adjusted-CLT UCL (Chen-1995)	496
		95% Modified-t UCL (Johnson-1978)	439.3

Gamma GOF Test

A-D Test Statistic	7.859	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.881	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.415	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.171	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.247	k star (bias corrected MLE)	0.245
Theta hat (MLE)	895.5	Theta star (bias corrected MLE)	904
nu hat (MLE)	15.82	nu star (bias corrected)	15.67
MLE Mean (bias corrected)	221.4	MLE Sd (bias corrected)	447.4
		Approximate Chi Square Value (0.05)	7.732
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	7.433

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	448.8	95% Adjusted Gamma UCL (use when n<50)	466.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.626	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.32	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.281	Mean of logged Data	2.522
Maximum of Logged Data	8.006	SD of logged Data	1.814

Assuming Lognormal Distribution

95% H-UCL	205.2	90% Chebyshev (MVUE) UCL	130.6
95% Chebyshev (MVUE) UCL	163.8	97.5% Chebyshev (MVUE) UCL	209.9
99% Chebyshev (MVUE) UCL	300.5		

Table B.25.2

Summary of ProUCL Output for Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	421.5	95% Jackknife UCL	427.6
95% Standard Bootstrap UCL	420.8	95% Bootstrap-t UCL	563.2
95% Hall's Bootstrap UCL	364.9	95% Percentile Bootstrap UCL	431.6
95% BCA Bootstrap UCL	518		
90% Chebyshev(Mean, Sd) UCL	586.3	95% Chebyshev(Mean, Sd) UCL	751.6
97.5% Chebyshev(Mean, Sd) UCL	981	99% Chebyshev(Mean, Sd) UCL	1432

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	751.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.25.2

Summary of ProUCL Output for Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	32	Number of Distinct Observations	4
Number of Detects	2	Number of Non-Detects	30
Number of Distinct Detects	2	Number of Distinct Non-Detects	2
Minimum Detect	0.23	Minimum Non-Detect	0.2
Maximum Detect	0.55	Maximum Non-Detect	0.82
Variance Detects	0.0512	Percent Non-Detects	93.75%
Mean Detects	0.39	SD Detects	0.226
Median Detects	0.39	CV Detects	0.58
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-1.034	SD of Logged Detects	0.616

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.213	KM Standard Error of Mean	0.0162
KM SD	0.0629	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.24	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.239	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.261	95% KM Chebyshev UCL	0.283
97.5% KM Chebyshev UCL	0.314	99% KM Chebyshev UCL	0.374

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	5.587	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0698	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	22.35	nu star (bias corrected)	N/A
Mean (detects)	0.39		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.213	SD (KM)	0.0629
Variance (KM)	0.00395	SE of Mean (KM)	0.0162
k hat (KM)	11.44	k star (KM)	10.39
nu hat (KM)	732.3	nu star (KM)	664.9
theta hat (KM)	0.0186	theta star (KM)	0.0205
80% gamma percentile (KM)	0.265	90% gamma percentile (KM)	0.3
95% gamma percentile (KM)	0.332	99% gamma percentile (KM)	0.395

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0416
Approximate Chi Square Value (664.94, α)	606.1	Adjusted Chi Square Value (664.94, β)	603.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.233	95% Gamma Adjusted KM-UCL (use when n<50)	0.234

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0319	Mean in Log Scale	-6.255
SD in Original Scale	0.103	SD in Log Scale	2.583
95% t UCL (assumes normality of ROS data)	0.063	95% Percentile Bootstrap UCL	0.0636
95% BCA Bootstrap UCL	0.0838	95% Bootstrap t UCL	0.231
95% H-UCL (Log ROS)	0.487		

Table B.25.2

Summary of ProUCL Output for Quarry Pond Surface Water
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.571	KM Geo Mean	0.208
KM SD (logged)	0.182	95% Critical H Value (KM-Log)	1.736
KM Standard Error of Mean (logged)	0.0471	95% H-UCL (KM -Log)	0.224
KM SD (logged)	0.182	95% Critical H Value (KM-Log)	1.736
KM Standard Error of Mean (logged)	0.0471		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.138	Mean in Log Scale	-2.135
SD in Original Scale	0.109	SD in Log Scale	0.464
95% t UCL (Assumes normality)	0.17	95% H-Stat UCL	0.154

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	0.283

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.26.1

Summary of ProUCL Input Data for Quarry Pond Surface Water Bioaccumulating to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

			0	1	2	3	4	5	6	7	8	9	10	11
EU:	**Sample Location:**	**Sample Date:**	1,2,4-Trichlorobenzene	D_1,2,4-Trichlorobenzene	Butyl benzylphthalate (BBP)	D_Butyl benzylphthalate (BBP)	Arsenic	D_Arsenic	Manganese	D_Manganese	Thallium	D_Thallium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
Quarry Pond	SW-1	9/18/2018	0.26	0	0.66	0	2.1	1	7.4	1	0.2	0	0.04	0
Quarry Pond	SW-1	9/18/2018	0.41	1	0.65	0	13	1	2000	1	0.2	0	0.41	0
Quarry Pond	SW-2	9/19/2018	0.26	0	0.67	0	1.8	1	5.2	1	0.2	0	0.074	1
Quarry Pond	SW-2	9/19/2018	0.26	0	0.65	0	14	1	1800	1	0.2	0	0.039	0
Quarry Pond	SW-3	9/20/2018	0.26	0	0.64	0	1.9	1	4.9	1	0.2	0	0.041	0
Quarry Pond	SW-3	9/20/2018	0.26	0	0.67	0	2	1	17	1	0.2	0	0.042	0
Quarry Pond	SW-4	9/19/2018	0.26	0	0.67	0	1.8	1	7.6	1	0.2	0	0.04	0
Quarry Pond	SW-5	9/19/2018	0.26	0	0.67	0	2	1	7.4	1	0.2	0	0.039	0
Quarry Pond	SW-6	9/19/2018	0.26	0	0.67	0	1.9	1	7.7	1	0.2	0	0.04	0
Quarry Pond	SW-7	9/20/2018	0.26	0	0.68	0	1.8	1	5.2	1	0.2	0	0.038	0
Quarry Pond	SW-7	9/20/2018	0.26	0	0.72	0	2	1	18	1	0.2	0	0.041	0
Quarry Pond	SW-8	9/19/2018	0.26	0	0.64	0	1.9	1	4.4	1	0.2	0	0.038	0
Quarry Pond	SW-8	9/19/2018	0.26	0	0.66	0	2.2	1	16	1	0.2	0	0.04	0
Quarry Pond	SW-9	9/19/2018	0.26	0	0.65	0	2	1	5.5	1	0.2	0	0.041	0
Quarry Pond	SW-10	9/18/2018	0.26	0	7.9	1	1.8	1	7.6	1	0.2	0	0.038	0
Quarry Pond	SW-1	10/2/2019	0.26	0	1.3	0	1.9	1	4.1	1	0.55	1	0.038	0
Quarry Pond	SW-1	10/2/2019	0.26	0	0.65	0	2.7	1	50	1	0.23	1	0.039	0
Quarry Pond	SW-2	10/2/2019	0.26	0	1.1	0	2	1	3.6	1	0.2	0	0.038	0
Quarry Pond	SW-2	10/2/2019	0.26	0	0.67	0	5.8	1	3000	1	0.2	0	0.038	0
Quarry Pond	SW-3	10/2/2019	0.26	0	0.64	0	1.7	1	4.4	1	0.2	0	0.038	0
Quarry Pond	SW-3	10/2/2019	0.26	0	0.66	0	2.1	1	20	1	0.2	0	0.039	0
Quarry Pond	SW-4	10/3/2019	0.26	0	0.63	0	1.8	1	4.9	1	0.2	0	0.039	0
Quarry Pond	SW-5	10/3/2019	0.26	0	0.65	0	1.7	1	5.8	1	0.2	0	0.038	0
Quarry Pond	SW-6	10/3/2019	0.26	0	0.63	0	1.8	1	3.7	1	0.82	0	0.038	0
Quarry Pond	SW-7	10/3/2019	0.26	0	0.64	0	1.8	1	6.8	1	0.2	0	0.039	0
Quarry Pond	SW-7	10/3/2019	0.26	0	0.65	0	2	1	36	1	0.2	0	0.039	0
Quarry Pond	SW-8	10/3/2019	0.26	0	0.65	0	2	1	3.7	1	0.82	0	0.04	0
Quarry Pond	SW-8	10/3/2019	0.26	0	0.64	0	2	1	7.8	1	0.2	0	0.038	0
Quarry Pond	SW-9	10/2/2019	0.26	0	1.2	0	1.8	1	3.9	1	0.2	0	0.038	0
Quarry Pond	SW-10	10/2/2019	0.26	0	0.65	0	1.8	1	5.3	1	0.2	0	0.038	0
Quarry Pond	SW-11	10/3/2019	0.26	0	0.64	0	1.6	1	5	1	0.2	0	0.038	0
Quarry Pond	SW-12	10/3/2019	0.26	0	0.65	0	1.7	1	5.4	1	0.2	0	0.039	0

Table B.26.2

Summary of ProUCL Output for Quarry Pond Surface Water Bioaccumulating to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

1,2,4-Trichlorobenzene

General Statistics

Total Number of Observations	32	Number of Distinct Observations	2
Number of Detects	1	Number of Non-Detects	31
Number of Distinct Detects	1	Number of Distinct Non-Detects	1

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable 1,2,4-Trichlorobenzene was not processed!

Butyl benzylphthalate (BBP)

General Statistics

Total Number of Observations	32	Number of Distinct Observations	11
Number of Detects	1	Number of Non-Detects	31
Number of Distinct Detects	1	Number of Distinct Non-Detects	10

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Butyl benzylphthalate (BBP) was not processed!

Table B.26.2

Summary of ProUCL Output for Quarry Pond Surface Water Bioaccumulating to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	32	Number of Distinct Observations	11
		Number of Missing Observations	0
Minimum	1.6	Mean	2.763
Maximum	14	Median	1.9
SD	2.908	Std. Error of Mean	0.514
Coefficient of Variation	1.053	Skewness	3.497

Normal GOF Test

Shapiro Wilk Test Statistic	0.379	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.452	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	3.634	95% Adjusted-CLT UCL (Chen-1995)	3.948
		95% Modified-t UCL (Johnson-1978)	3.687

Gamma GOF Test

A-D Test Statistic	7.739	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.756	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.427	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.157	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.499	k star (bias corrected MLE)	2.285
Theta hat (MLE)	1.106	Theta star (bias corrected MLE)	1.209
nu hat (MLE)	159.9	nu star (bias corrected)	146.3
MLE Mean (bias corrected)	2.763	MLE Sd (bias corrected)	1.827
		Approximate Chi Square Value (0.05)	119.3
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	118

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	3.387	95% Adjusted Gamma UCL (use when n<50)	3.424

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.497	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.39	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.47	Mean of logged Data	0.803
Maximum of Logged Data	2.639	SD of logged Data	0.52

Assuming Lognormal Distribution

95% H-UCL	3.065	90% Chebyshev (MVUE) UCL	3.278
95% Chebyshev (MVUE) UCL	3.611	97.5% Chebyshev (MVUE) UCL	4.073
99% Chebyshev (MVUE) UCL	4.981		

Table B.26.2

Summary of ProUCL Output for Quarry Pond Surface Water Bioaccumulating to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	3.608	95% Jackknife UCL	3.634
95% Standard Bootstrap UCL	3.585	95% Bootstrap-t UCL	5.862
95% Hall's Bootstrap UCL	6.513	95% Percentile Bootstrap UCL	3.669
95% BCA Bootstrap UCL	4.066		
90% Chebyshev(Mean, Sd) UCL	4.305	95% Chebyshev(Mean, Sd) UCL	5.004
97.5% Chebyshev(Mean, Sd) UCL	5.973	99% Chebyshev(Mean, Sd) UCL	7.878

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	5.004

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.26.2

Summary of ProUCL Output for Quarry Pond Surface Water Bioaccumulating to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	32	Number of Distinct Observations	26
		Number of Missing Observations	0
Minimum	3.6	Mean	221.4
Maximum	3000	Median	6.3
SD	688.1	Std. Error of Mean	121.6
Coefficient of Variation	3.108	Skewness	3.246

Normal GOF Test

Shapiro Wilk Test Statistic	0.36	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.505	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	427.6	95% Adjusted-CLT UCL (Chen-1995)	496
		95% Modified-t UCL (Johnson-1978)	439.3

Gamma GOF Test

A-D Test Statistic	7.859	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.881	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.415	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.171	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	0.247	k star (bias corrected MLE)	0.245
Theta hat (MLE)	895.5	Theta star (bias corrected MLE)	904
nu hat (MLE)	15.82	nu star (bias corrected)	15.67
MLE Mean (bias corrected)	221.4	MLE Sd (bias corrected)	447.4
		Approximate Chi Square Value (0.05)	7.732
Adjusted Level of Significance	0.0416	Adjusted Chi Square Value	7.433

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	448.8	95% Adjusted Gamma UCL (use when n<50)	466.8

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.626	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.93	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.32	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.154	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.281	Mean of logged Data	2.522
Maximum of Logged Data	8.006	SD of logged Data	1.814

Assuming Lognormal Distribution

95% H-UCL	205.2	90% Chebyshev (MVUE) UCL	130.6
95% Chebyshev (MVUE) UCL	163.8	97.5% Chebyshev (MVUE) UCL	209.9
99% Chebyshev (MVUE) UCL	300.5		

Table B.26.2

Summary of ProUCL Output for Quarry Pond Surface Water Bioaccumulating to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	421.5	95% Jackknife UCL	427.6
95% Standard Bootstrap UCL	420.8	95% Bootstrap-t UCL	563.2
95% Hall's Bootstrap UCL	364.9	95% Percentile Bootstrap UCL	431.6
95% BCA Bootstrap UCL	518		
90% Chebyshev(Mean, Sd) UCL	586.3	95% Chebyshev(Mean, Sd) UCL	751.6
97.5% Chebyshev(Mean, Sd) UCL	981	99% Chebyshev(Mean, Sd) UCL	1432

Suggested UCL to Use

95% Chebyshev (Mean, Sd) UCL	751.6

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.26.2

Summary of ProUCL Output for Quarry Pond Surface Water Bioaccumulating to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	32	Number of Distinct Observations	4
Number of Detects	2	Number of Non-Detects	30
Number of Distinct Detects	2	Number of Distinct Non-Detects	2
Minimum Detect	0.23	Minimum Non-Detect	0.2
Maximum Detect	0.55	Maximum Non-Detect	0.82
Variance Detects	0.0512	Percent Non-Detects	93.75%
Mean Detects	0.39	SD Detects	0.226
Median Detects	0.39	CV Detects	0.58
Skewness Detects	N/A	Kurtosis Detects	N/A
Mean of Logged Detects	-1.034	SD of Logged Detects	0.616

Warning: Data set has only 2 Detected Values.
This is not enough to compute meaningful or reliable statistics and estimates.

Normal GOF Test on Detects Only
Not Enough Data to Perform GOF Test

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.213	KM Standard Error of Mean	0.0162
KM SD	0.0629	95% KM (BCA) UCL	N/A
95% KM (t) UCL	0.24	95% KM (Percentile Bootstrap) UCL	N/A
95% KM (z) UCL	0.239	95% KM Bootstrap t UCL	N/A
90% KM Chebyshev UCL	0.261	95% KM Chebyshev UCL	0.283
97.5% KM Chebyshev UCL	0.314	99% KM Chebyshev UCL	0.374

Gamma GOF Tests on Detected Observations Only
Not Enough Data to Perform GOF Test

Gamma Statistics on Detected Data Only

k hat (MLE)	5.587	k star (bias corrected MLE)	N/A
Theta hat (MLE)	0.0698	Theta star (bias corrected MLE)	N/A
nu hat (MLE)	22.35	nu star (bias corrected)	N/A
Mean (detects)	0.39		

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.213	SD (KM)	0.0629
Variance (KM)	0.00395	SE of Mean (KM)	0.0162
k hat (KM)	11.44	k star (KM)	10.39
nu hat (KM)	732.3	nu star (KM)	664.9
theta hat (KM)	0.0186	theta star (KM)	0.0205
80% gamma percentile (KM)	0.265	90% gamma percentile (KM)	0.3
95% gamma percentile (KM)	0.332	99% gamma percentile (KM)	0.395

Gamma Kaplan-Meier (KM) Statistics

		Adjusted Level of Significance (β)	0.0416
Approximate Chi Square Value (664.94, α)	606.1	Adjusted Chi Square Value (664.94, β)	603.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.233	95% Gamma Adjusted KM-UCL (use when n<50)	0.234

Lognormal GOF Test on Detected Observations Only
Not Enough Data to Perform GOF Test

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.0319	Mean in Log Scale	-6.255
SD in Original Scale	0.103	SD in Log Scale	2.583
95% t UCL (assumes normality of ROS data)	0.063	95% Percentile Bootstrap UCL	0.0636
95% BCA Bootstrap UCL	0.0838	95% Bootstrap t UCL	0.231
95% H-UCL (Log ROS)	0.487		

Table B.26.2

Summary of ProUCL Output for Quarry Pond Surface Water Bioaccumulating to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-1.571	KM Geo Mean	0.208
KM SD (logged)	0.182	95% Critical H Value (KM-Log)	1.736
KM Standard Error of Mean (logged)	0.0471	95% H-UCL (KM -Log)	0.224
KM SD (logged)	0.182	95% Critical H Value (KM-Log)	1.736
KM Standard Error of Mean (logged)	0.0471		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.138	Mean in Log Scale	-2.135
SD in Original Scale	0.109	SD in Log Scale	0.464
95% t UCL (Assumes normality)	0.17	95% H-Stat UCL	0.154

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	0.283

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.26.2

Summary of ProUCL Output for Quarry Pond Surface Water Bioaccumulating to Fish
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.112/16/2019 11:28:04 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	32	Number of Distinct Observations	7
Number of Detects	1	Number of Non-Detects	31
Number of Distinct Detects	1	Number of Distinct Non-Detects	6

Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set!
It is suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BTV).

The data set for variable Aroclor-1254 (PCB-1254) was not processed!

Table B.27.1

Summary of ProUCL Input Data for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9
EU:	**Sample Location**	**Sample Date:**	**Sample Depth:**	Benzo(a)pyrene	D_Benzo(a)pyrene	Carbazole	D_Carbazole	Aluminum	D_Aluminum	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)
Background (Floodplain)	SS-201	12/10/2018	0.5-2 ft BGS	490	1	84	1	7200	1	7.1	1	2.3	1
Background (Floodplain)	SS-201	12/10/2018	0-0.5 ft BGS	280	1	39	1	6400	1	6.7	1	2.1	1
Background (Floodplain)	SS-202	12/10/2018	0.5-2 ft BGS	540	1	54	1	11000	1	9.5	1	5.3	1
Background (Floodplain)	SS-202	12/10/2018	0-0.5 ft BGS	540	1	57	1	9600	1	8.2	1	2.9	1
Background (Floodplain)	SS-203	12/10/2018	0.5-2 ft BGS	330	1	29	1	11000	1	10	1	5.7	1
Background (Floodplain)	SS-203	12/10/2018	0-0.5 ft BGS	350	1	33	1	9800	1	8.6	1	3.0	1
Background (Floodplain)	SS-204	12/10/2018	0.5-2 ft BGS	320	1	33	1	12000	1	9.9	1	4.2	1
Background (Floodplain)	SS-204	12/10/2018	0-0.5 ft BGS	310	1	30	1	10000	1	8.5	1	2.9	1
Background (Floodplain)	SS-205	12/10/2018	0.5-2 ft BGS	320	1	34	1	11000	1	9.8	1	5.1	1
Background (Floodplain)	SS-205	12/10/2018	0-0.5 ft BGS	390	1	41	1	10000	1	8.3	1	2.9	1
Background (Floodplain)	SS-206	12/10/2018	0.5-2 ft BGS	67	1	24	0	13000	1	9.7	1	2.6	1
Background (Floodplain)	SS-206	12/10/2018	0-0.5 ft BGS	63	1	24	0	11000	1	7.6	1	2.1	1
Background (Floodplain)	SS-207	12/10/2018	0.5-2 ft BGS	510	1	42	1	11000	1	9.9	1	6.3	1
Background (Floodplain)	SS-207	12/10/2018	0-0.5 ft BGS	440	1	42	1	9000	1	8.1	1	2.7	1
Background (Floodplain)	SS-208	12/10/2018	0.5-2 ft BGS	375	1	40.5	1	12000	1	9.95	1	5.4	1
Background (Floodplain)	SS-208	12/10/2018	0-0.5 ft BGS	320	1	33	1	9200	1	8.3	1	2.9	1

Table B.27.1

Summary of ProUCL Input Data for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				10	11	12	13	14	15	16	17	18	19
EU:	**ample Locatior**	**Sample Date:**	**Sample Depth:**	Cobalt	D_Cobalt	Iron	D_Iron	Manganese	D_Manganese	Thallium	D_Thallium	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
Background (Floodplain)	SS-201	12/10/2018	0.5-2 ft BGS	5.1	1	14000	1	370	1	0.21	1	93	1
Background (Floodplain)	SS-201	12/10/2018	0-0.5 ft BGS	5.0	1	13000	1	350	1	0.19	1	72	1
Background (Floodplain)	SS-202	12/10/2018	0.5-2 ft BGS	7.9	1	20000	1	560	1	0.35	1	330	1
Background (Floodplain)	SS-202	12/10/2018	0-0.5 ft BGS	7.1	1	19000	1	540	1	0.31	1	210	1
Background (Floodplain)	SS-203	12/10/2018	0.5-2 ft BGS	8.4	1	21000	1	590	1	0.37	1	2800	1
Background (Floodplain)	SS-203	12/10/2018	0-0.5 ft BGS	7.4	1	19000	1	580	1	0.32	1	150	1
Background (Floodplain)	SS-204	12/10/2018	0.5-2 ft BGS	8.4	1	22000	1	590	1	0.38	1	205	1
Background (Floodplain)	SS-204	12/10/2018	0-0.5 ft BGS	7.4	1	19000	1	560	1	0.33	1	160	1
Background (Floodplain)	SS-205	12/10/2018	0.5-2 ft BGS	8.0	1	21000	1	560	1	0.37	1	3300	1
Background (Floodplain)	SS-205	12/10/2018	0-0.5 ft BGS	7.3	1	19000	1	580	1	0.32	1	160	1
Background (Floodplain)	SS-206	12/10/2018	0.5-2 ft BGS	12	1	23000	1	1000	1	0.2	1	29	0
Background (Floodplain)	SS-206	12/10/2018	0-0.5 ft BGS	13	1	19000	1	1000	1	0.19	1	28	0
Background (Floodplain)	SS-207	12/10/2018	0.5-2 ft BGS	8.1	1	20000	1	570	1	0.36	1	1500	1
Background (Floodplain)	SS-207	12/10/2018	0-0.5 ft BGS	7.0	1	18000	1	550	1	0.29	1	110	1
Background (Floodplain)	SS-208	12/10/2018	0.5-2 ft BGS	8.35	1	21000	1	590	1	0.39	1	980	1
Background (Floodplain)	SS-208	12/10/2018	0-0.5 ft BGS	7.1	1	18000	1	560	1	0.31	1	140	1

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	16	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	63	Mean	352.8
Maximum	540	Median	340
SD	141.3	Std. Error of Mean	35.34
Coefficient of Variation	0.401	Skewness	-0.755

Normal GOF Test

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	414.8	95% Adjusted-CLT UCL (Chen-1995)	403.8
		95% Modified-t UCL (Johnson-1978)	413.6

Gamma GOF Test

A-D Test Statistic	1.421	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.742	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.283	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.216	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	3.825	k star (bias corrected MLE)	3.15
Theta hat (MLE)	92.24	Theta star (bias corrected MLE)	112
nu hat (MLE)	122.4	nu star (bias corrected)	100.8
MLE Mean (bias corrected)	352.8	MLE Sd (bias corrected)	198.8
		Approximate Chi Square Value (0.05)	78.62
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	76.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	452.3	95% Adjusted Gamma UCL (use when n<50)	465.4

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.704	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.317	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	4.143	Mean of logged Data	5.73
Maximum of Logged Data	6.292	SD of logged Data	0.643

Assuming Lognormal Distribution

95% H-UCL	546.4	90% Chebyshev (MVUE) UCL	561.6
95% Chebyshev (MVUE) UCL	647	97.5% Chebyshev (MVUE) UCL	765.7
99% Chebyshev (MVUE) UCL	998.7		

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	410.9	95% Jackknife UCL	414.8
95% Standard Bootstrap UCL	409.9	95% Bootstrap-t UCL	407.2
95% Hall's Bootstrap UCL	403.4	95% Percentile Bootstrap UCL	408.6
95% BCA Bootstrap UCL	403.6		
90% Chebyshev(Mean, Sd) UCL	458.8	95% Chebyshev(Mean, Sd) UCL	506.8
97.5% Chebyshev(Mean, Sd) UCL	573.5	99% Chebyshev(Mean, Sd) UCL	704.4

Suggested UCL to Use

95% Student's-t UCL	414.8

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	16	Number of Distinct Observations	12
Number of Detects	14	Number of Non-Detects	2
Number of Distinct Detects	11	Number of Distinct Non-Detects	1
Minimum Detect	29	Minimum Non-Detect	24
Maximum Detect	84	Maximum Non-Detect	24
Variance Detects	212.6	Percent Non-Detects	12.5%
Mean Detects	42.25	SD Detects	14.58
Median Detects	39.75	CV Detects	0.345
Skewness Detects	2.039	Kurtosis Detects	4.778
Mean of Logged Detects	3.7	SD of Logged Detects	0.29

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.775	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.293	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	39.97	KM Standard Error of Mean	3.752
KM SD	14.46	95% KM (BCA) UCL	47
95% KM (t) UCL	46.55	95% KM (Percentile Bootstrap) UCL	46.34
95% KM (z) UCL	46.14	95% KM Bootstrap t UCL	50.54
90% KM Chebyshev UCL	51.23	95% KM Chebyshev UCL	56.33
97.5% KM Chebyshev UCL	63.4	99% KM Chebyshev UCL	77.31

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.792	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.734	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.255	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.229	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	11.65	k star (bias corrected MLE)	9.201
Theta hat (MLE)	3.627	Theta star (bias corrected MLE)	4.592
nu hat (MLE)	326.2	nu star (bias corrected)	257.6
Mean (detects)	42.25		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	12.85	Mean	38.84
Maximum	84	Median	36.5
SD	16.48	CV	0.424
k hat (MLE)	6.055	k star (bias corrected MLE)	4.961
Theta hat (MLE)	6.415	Theta star (bias corrected MLE)	7.829
nu hat (MLE)	193.8	nu star (bias corrected)	158.8
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (158.76, α)	130.6	Adjusted Chi Square Value (158.76, β)	127.7
95% Gamma Approximate UCL (use when n>=50)	47.21	95% Gamma Adjusted UCL (use when n<50)	48.28

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	39.97	SD (KM)	14.46
Variance (KM)	209.2	SE of Mean (KM)	3.752
k hat (KM)	7.636	k star (KM)	6.246
nu hat (KM)	244.4	nu star (KM)	199.9
theta hat (KM)	5.234	theta star (KM)	6.399
80% gamma percentile (KM)	52.44	90% gamma percentile (KM)	61.34
95% gamma percentile (KM)	69.38	99% gamma percentile (KM)	86.21

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (199.87, α)	168.2	Adjusted Chi Square Value (199.87, β)	164.9
95% Gamma Approximate KM-UCL (use when n>=50)	47.51	95% Gamma Adjusted KM-UCL (use when n<50)	48.46

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.879	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.874	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.234	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.226	Detected Data Not Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	39.57	Mean in Log Scale	3.617
SD in Original Scale	15.43	SD in Log Scale	0.354
95% t UCL (assumes normality of ROS data)	46.34	95% Percentile Bootstrap UCL	45.86
95% BCA Bootstrap UCL	47.66	95% Bootstrap t UCL	49.17
95% H-UCL (Log ROS)	47.2		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.635	KM Geo Mean	37.9
KM SD (logged)	0.313	95% Critical H Value (KM-Log)	1.881
KM Standard Error of Mean (logged)	0.0813	95% H-UCL (KM -Log)	46.35
KM SD (logged)	0.313	95% Critical H Value (KM-Log)	1.881
KM Standard Error of Mean (logged)	0.0813		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	38.47	Mean in Log Scale	3.548
SD in Original Scale	17.06	SD in Log Scale	0.495
95% t UCL (Assumes normality)	45.95	95% H-Stat UCL	51.02

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	46.55	KM H-UCL	46.35

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	16	Number of Distinct Observations	10
		Number of Missing Observations	0
Minimum	6400	Mean	10200
Maximum	13000	Median	10500
SD	1713	Std. Error of Mean	428.2
Coefficient of Variation	0.168	Skewness	-0.739

Normal GOF Test

Shapiro Wilk Test Statistic	0.938	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.18	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	10951	95% Adjusted-CLT UCL (Chen-1995)	10820
		95% Modified-t UCL (Johnson-1978)	10937

Gamma GOF Test

A-D Test Statistic	0.627	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.192	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.215	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	33.8	k star (bias corrected MLE)	27.51
Theta hat (MLE)	301.8	Theta star (bias corrected MLE)	370.8
nu hat (MLE)	1082	nu star (bias corrected)	880.2
MLE Mean (bias corrected)	10200	MLE Sd (bias corrected)	1945
		Approximate Chi Square Value (0.05)	812.3
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	804.9

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	11052	95% Adjusted Gamma UCL (use when n<50)	11154

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.891	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.188	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.764	Mean of logged Data	9.215
Maximum of Logged Data	9.473	SD of logged Data	0.184

Assuming Lognormal Distribution

95% H-UCL	11128	90% Chebyshev (MVUE) UCL	11625
95% Chebyshev (MVUE) UCL	12266	97.5% Chebyshev (MVUE) UCL	13156
99% Chebyshev (MVUE) UCL	14903		

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	10904	95% Jackknife UCL	10951
95% Standard Bootstrap UCL	10878	95% Bootstrap-t UCL	10852
95% Hall's Bootstrap UCL	10838	95% Percentile Bootstrap UCL	10850
95% BCA Bootstrap UCL	10813		
90% Chebyshev(Mean, Sd) UCL	11485	95% Chebyshev(Mean, Sd) UCL	12066
97.5% Chebyshev(Mean, Sd) UCL	12874	99% Chebyshev(Mean, Sd) UCL	14460

Suggested UCL to Use

95% Student's-t UCL	10951

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	16	Number of Distinct Observations	14
		Number of Missing Observations	0
Minimum	6.7	Mean	8.759
Maximum	10	Median	8.55
SD	1.086	Std. Error of Mean	0.271
Coefficient of Variation	0.124	Skewness	-0.394

Normal GOF Test

Shapiro Wilk Test Statistic	0.896	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.19	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level

Data appear Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	9.235	95% Adjusted-CLT UCL (Chen-1995)	9.177
		95% Modified-t UCL (Johnson-1978)	9.231

Gamma GOF Test

A-D Test Statistic	0.686	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.736	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.199	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.214	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	66.68	k star (bias corrected MLE)	54.22
Theta hat (MLE)	0.131	Theta star (bias corrected MLE)	0.162
nu hat (MLE)	2134	nu star (bias corrected)	1735
MLE Mean (bias corrected)	8.759	MLE Sd (bias corrected)	1.19
		Approximate Chi Square Value (0.05)	1639
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	1629

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	9.271	95% Adjusted Gamma UCL (use when n<50)	9.331

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.193	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Lognormal at 5% Significance Level

Data appear Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.902	Mean of logged Data	2.163
Maximum of Logged Data	2.303	SD of logged Data	0.128

Assuming Lognormal Distribution

95% H-UCL	9.29	90% Chebyshev (MVUE) UCL	9.604
95% Chebyshev (MVUE) UCL	9.986	97.5% Chebyshev (MVUE) UCL	10.52
99% Chebyshev (MVUE) UCL	11.56		

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	9.206	95% Jackknife UCL	9.235
95% Standard Bootstrap UCL	9.186	95% Bootstrap-t UCL	9.206
95% Hall's Bootstrap UCL	9.17	95% Percentile Bootstrap UCL	9.172
95% BCA Bootstrap UCL	9.178		
90% Chebyshev(Mean, Sd) UCL	9.574	95% Chebyshev(Mean, Sd) UCL	9.942
97.5% Chebyshev(Mean, Sd) UCL	10.45	99% Chebyshev(Mean, Sd) UCL	11.46

Suggested UCL to Use

95% Student's-t UCL	9.235

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	16	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	2.1	Mean	3.65
Maximum	6.3	Median	2.9
SD	1.431	Std. Error of Mean	0.358
Coefficient of Variation	0.392	Skewness	0.686

Normal GOF Test

Shapiro Wilk Test Statistic	0.846	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.3	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	4.277	95% Adjusted-CLT UCL (Chen-1995)	4.304
		95% Modified-t UCL (Johnson-1978)	4.287

Gamma GOF Test

A-D Test Statistic	0.999	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.74	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.279	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.215	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.481	k star (bias corrected MLE)	6.12
Theta hat (MLE)	0.488	Theta star (bias corrected MLE)	0.596
nu hat (MLE)	239.4	nu star (bias corrected)	195.8
MLE Mean (bias corrected)	3.65	MLE Sd (bias corrected)	1.475
		Approximate Chi Square Value (0.05)	164.5
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	161.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	4.346	95% Adjusted Gamma UCL (use when n<50)	4.435

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.881	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.258	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.742	Mean of logged Data	1.226
Maximum of Logged Data	1.841	SD of logged Data	0.377

Assuming Lognormal Distribution

95% H-UCL	4.416	90% Chebyshev (MVUE) UCL	4.69
95% Chebyshev (MVUE) UCL	5.164	97.5% Chebyshev (MVUE) UCL	5.823
99% Chebyshev (MVUE) UCL	7.117		

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	4.238	95% Jackknife UCL	4.277
95% Standard Bootstrap UCL	4.23	95% Bootstrap-t UCL	4.384
95% Hall's Bootstrap UCL	4.211	95% Percentile Bootstrap UCL	4.238
95% BCA Bootstrap UCL	4.275		
90% Chebyshev(Mean, Sd) UCL	4.723	95% Chebyshev(Mean, Sd) UCL	5.209
97.5% Chebyshev(Mean, Sd) UCL	5.884	99% Chebyshev(Mean, Sd) UCL	7.21

Suggested UCL to Use

95% Student's-t UCL	4.277	or 95% Modified-t UCL	4.287

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	16	Number of Distinct Observations	13
		Number of Missing Observations	0
Minimum	5	Mean	7.972
Maximum	13	Median	7.65
SD	2.044	Std. Error of Mean	0.511
Coefficient of Variation	0.256	Skewness	1.247

Normal GOF Test

Shapiro Wilk Test Statistic	0.833	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.292	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	8.868	95% Adjusted-CLT UCL (Chen-1995)	8.983
		95% Modified-t UCL (Johnson-1978)	8.894

Gamma GOF Test

A-D Test Statistic	0.964	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.737	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.256	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.215	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	17.85	k star (bias corrected MLE)	14.55
Theta hat (MLE)	0.447	Theta star (bias corrected MLE)	0.548
nu hat (MLE)	571.2	nu star (bias corrected)	465.4
MLE Mean (bias corrected)	7.972	MLE Sd (bias corrected)	2.09
		Approximate Chi Square Value (0.05)	416.4
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	411.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	8.91	95% Adjusted Gamma UCL (use when n<50)	9.025

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.885	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.245	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	1.609	Mean of logged Data	2.048
Maximum of Logged Data	2.565	SD of logged Data	0.242

Assuming Lognormal Distribution

95% H-UCL	8.948	90% Chebyshev (MVUE) UCL	9.425
95% Chebyshev (MVUE) UCL	10.09	97.5% Chebyshev (MVUE) UCL	11
99% Chebyshev (MVUE) UCL	12.81		

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	8.813	95% Jackknife UCL	8.868
95% Standard Bootstrap UCL	8.801	95% Bootstrap-t UCL	9.288
95% Hall's Bootstrap UCL	14.8	95% Percentile Bootstrap UCL	8.838
95% BCA Bootstrap UCL	8.95		
90% Chebyshev(Mean, Sd) UCL	9.505	95% Chebyshev(Mean, Sd) UCL	10.2
97.5% Chebyshev(Mean, Sd) UCL	11.16	99% Chebyshev(Mean, Sd) UCL	13.06

Suggested UCL to Use

95% Student's-t UCL	8.868	or 95% Modified-t UCL	8.894

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	16	Number of Distinct Observations	8
		Number of Missing Observations	0
Minimum	13000	Mean	19125
Maximum	23000	Median	19000
SD	2604	Std. Error of Mean	651.1
Coefficient of Variation	0.136	Skewness	-1.139

Normal GOF Test

Shapiro Wilk Test Statistic	0.882	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.231	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	20266	95% Adjusted-CLT UCL (Chen-1995)	19998
		95% Modified-t UCL (Johnson-1978)	20236

Gamma GOF Test

A-D Test Statistic	1.003	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.735	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.25	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.214	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	50.98	k star (bias corrected MLE)	41.47
Theta hat (MLE)	375.1	Theta star (bias corrected MLE)	461.2
nu hat (MLE)	1631	nu star (bias corrected)	1327
MLE Mean (bias corrected)	19125	MLE Sd (bias corrected)	2970
		Approximate Chi Square Value (0.05)	1243
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	1234

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	20411	95% Adjusted Gamma UCL (use when n<50)	20563

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.831	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.259	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	9.473	Mean of logged Data	9.849
Maximum of Logged Data	10.04	SD of logged Data	0.15

Assuming Lognormal Distribution

95% H-UCL	20507	90% Chebyshev (MVUE) UCL	21293
95% Chebyshev (MVUE) UCL	22270	97.5% Chebyshev (MVUE) UCL	23625
99% Chebyshev (MVUE) UCL	26287		

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	20196	95% Jackknife UCL	20266
95% Standard Bootstrap UCL	20177	95% Bootstrap-t UCL	20108
95% Hall's Bootstrap UCL	20040	95% Percentile Bootstrap UCL	20063
95% BCA Bootstrap UCL	19875		
90% Chebyshev(Mean, Sd) UCL	21078	95% Chebyshev(Mean, Sd) UCL	21963
97.5% Chebyshev(Mean, Sd) UCL	23191	99% Chebyshev(Mean, Sd) UCL	25604

Suggested UCL to Use

95% Student's-t UCL 20266 or 95% Modified-t UCL 20236

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	16	Number of Distinct Observations	9
		Number of Missing Observations	0
Minimum	350	Mean	596.9
Maximum	1000	Median	565
SD	173.2	Std. Error of Mean	43.29
Coefficient of Variation	0.29	Skewness	1.523

Normal GOF Test

Shapiro Wilk Test Statistic	0.707	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.391	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	672.8	95% Adjusted-CLT UCL (Chen-1995)	685.7
		95% Modified-t UCL (Johnson-1978)	675.5

Gamma GOF Test

A-D Test Statistic	2.004	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.738	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.358	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.215	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	14.58	k star (bias corrected MLE)	11.89
Theta hat (MLE)	40.95	Theta star (bias corrected MLE)	50.22
nu hat (MLE)	466.5	nu star (bias corrected)	380.3
MLE Mean (bias corrected)	596.9	MLE Sd (bias corrected)	173.1
		Approximate Chi Square Value (0.05)	336.1
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	331.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	675.4	95% Adjusted Gamma UCL (use when n<50)	685

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.774	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.34	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.858	Mean of logged Data	6.357
Maximum of Logged Data	6.908	SD of logged Data	0.266

Assuming Lognormal Distribution

95% H-UCL	678.2	90% Chebyshev (MVUE) UCL	716.2
95% Chebyshev (MVUE) UCL	770.6	97.5% Chebyshev (MVUE) UCL	846.2
99% Chebyshev (MVUE) UCL	994.6		

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution (0.05)

Nonparametric Distribution Free UCLs

95% CLT UCL	668.1	95% Jackknife UCL	672.8
95% Standard Bootstrap UCL	669.1	95% Bootstrap-t UCL	735.9
95% Hall's Bootstrap UCL	1281	95% Percentile Bootstrap UCL	675
95% BCA Bootstrap UCL	676.3		
90% Chebyshev(Mean, Sd) UCL	726.7	95% Chebyshev(Mean, Sd) UCL	785.6
97.5% Chebyshev(Mean, Sd) UCL	867.2	99% Chebyshev(Mean, Sd) UCL	1028

Suggested UCL to Use

95% Student's-t UCL	672.8	or 95% Modified-t UCL	675.5

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	16	Number of Distinct Observations	12
		Number of Missing Observations	0
Minimum	0.19	Mean	0.306
Maximum	0.39	Median	0.32
SD	0.0703	Std. Error of Mean	0.0176
Coefficient of Variation	0.23	Skewness	-0.73

Normal GOF Test

Shapiro Wilk Test Statistic	0.862	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.212	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.213	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.336	95% Adjusted-CLT UCL (Chen-1995)	0.331
		95% Modified-t UCL (Johnson-1978)	0.336

Gamma GOF Test

A-D Test Statistic	1.139	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.737	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.243	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.215	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	17.48	k star (bias corrected MLE)	14.24
Theta hat (MLE)	0.0175	Theta star (bias corrected MLE)	0.0215
nu hat (MLE)	559.2	nu star (bias corrected)	455.7
MLE Mean (bias corrected)	0.306	MLE Sd (bias corrected)	0.081
		Approximate Chi Square Value (0.05)	407.2
Adjusted Level of Significance	0.0335	Adjusted Chi Square Value	402

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	0.342	95% Adjusted Gamma UCL (use when n<50)	0.346

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.819	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.887	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.254	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.213	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-1.661	Mean of logged Data	-1.214
Maximum of Logged Data	-0.942	SD of logged Data	0.258

Assuming Lognormal Distribution

95% H-UCL	0.347	90% Chebyshev (MVUE) UCL	0.366
95% Chebyshev (MVUE) UCL	0.393	97.5% Chebyshev (MVUE) UCL	0.431
99% Chebyshev (MVUE) UCL	0.505		

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.335	95% Jackknife UCL	0.336
95% Standard Bootstrap UCL	0.333	95% Bootstrap-t UCL	0.333
95% Hall's Bootstrap UCL	0.33	95% Percentile Bootstrap UCL	0.333
95% BCA Bootstrap UCL	0.33		
90% Chebyshev(Mean, Sd) UCL	0.358	95% Chebyshev(Mean, Sd) UCL	0.382
97.5% Chebyshev(Mean, Sd) UCL	0.415	99% Chebyshev(Mean, Sd) UCL	0.481

Suggested UCL to Use

95% Student's-t UCL	0.336

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	16	Number of Distinct Observations	15
Number of Detects	14	Number of Non-Detects	2
Number of Distinct Detects	13	Number of Distinct Non-Detects	2
Minimum Detect	72	Minimum Non-Detect	28
Maximum Detect	3300	Maximum Non-Detect	29
Variance Detects	1139127	Percent Non-Detects	12.5%
Mean Detects	729.3	SD Detects	1067
Median Detects	182.5	CV Detects	1.463
Skewness Detects	1.805	Kurtosis Detects	2.151
Mean of Logged Detects	5.737	SD of Logged Detects	1.279

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.655	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.36	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	641.6	KM Standard Error of Mean	256.7
KM SD	989.6	95% KM (BCA) UCL	1091
95% KM (t) UCL	1092	95% KM (Percentile Bootstrap) UCL	1095
95% KM (z) UCL	1064	95% KM Bootstrap t UCL	1627
90% KM Chebyshev UCL	1412	95% KM Chebyshev UCL	1761
97.5% KM Chebyshev UCL	2245	99% KM Chebyshev UCL	3196

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.403	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.775	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.314	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.238	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.706	k star (bias corrected MLE)	0.602
Theta hat (MLE)	1033	Theta star (bias corrected MLE)	1211
nu hat (MLE)	19.77	nu star (bias corrected)	16.87
Mean (detects)	729.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	638.1
Maximum	3300	Median	160
SD	1024	CV	1.605
k hat (MLE)	0.336	k star (bias corrected MLE)	0.315
Theta hat (MLE)	1899	Theta star (bias corrected MLE)	2028
nu hat (MLE)	10.75	nu star (bias corrected)	10.07
Adjusted Level of Significance (β)	0.0335		
Approximate Chi Square Value (10.07, α)	3.986	Adjusted Chi Square Value (10.07, β)	3.561
95% Gamma Approximate UCL (use when n>=50)	1612	95% Gamma Adjusted UCL (use when n<50)	1805

Table B.27.2

Summary of ProUCL Output for Floodplain Background Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.13/24/2020 3:48:04 PM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	641.6	SD (KM)	989.6
Variance (KM)	979331	SE of Mean (KM)	256.7
k hat (KM)	0.42	k star (KM)	0.383
nu hat (KM)	13.45	nu star (KM)	12.26
theta hat (KM)	1526	theta star (KM)	1674
80% gamma percentile (KM)	1030	90% gamma percentile (KM)	1826
95% gamma percentile (KM)	2706	99% gamma percentile (KM)	4928

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (12.26, α)	5.401	Adjusted Chi Square Value (12.26, β)	4.891
95% Gamma Approximate KM-UCL (use when n>=50)	1457	95% Gamma Adjusted KM-UCL (use when n<50)	1609

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.852	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.874	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.263	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.226	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	640.3	Mean in Log Scale	5.375
SD in Original Scale	1023	SD in Log Scale	1.548
95% t UCL (assumes normality of ROS data)	1089	95% Percentile Bootstrap UCL	1092
95% BCA Bootstrap UCL	1180	95% Bootstrap t UCL	1619
95% H-UCL (Log ROS)	3055		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	5.437	KM Geo Mean	229.7
KM SD (logged)	1.401	95% Critical H Value (KM-Log)	3.367
KM Standard Error of Mean (logged)	0.363	95% H-UCL (KM -Log)	2070
KM SD (logged)	1.401	95% Critical H Value (KM-Log)	3.367
KM Standard Error of Mean (logged)	0.363		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	639.9	Mean in Log Scale	5.352
SD in Original Scale	1023	SD in Log Scale	1.589
95% t UCL (Assumes normality)	1088	95% H-Stat UCL	3409

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	1761

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.3

Summary of ProUCL Input Data for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				0	1	2	3	4	5	6	7	8	9	10
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_Benzo(b)fluoranthene	Carbazole	D_Carbazole	Dibenz(a,h)anthracene	D_Dibenz(a,h)anthracene	Dibenzofuran
Floodplain	SS-164	8/6/2018	0.67-2.17 ft BGS	39	1	50	1	70	1	26	0	0.92	0	18
Floodplain	SS-164	8/6/2018	0.17-0.67 ft BGS	570	1	590	1	1000	1	120	1	120	1	68
Floodplain	SS-165	8/6/2018	0.67-2.17 ft BGS	270	1	230	1	370	1	84	1	38	1	30
Floodplain	SS-165	8/6/2018	0.17-0.67 ft BGS	105	1	120	1	195	1	22	0	0.755	0	15
Floodplain	SS-166	8/7/2018	0.67-2.17 ft BGS	200	1	210	1	310	1	23	0	0.81	0	16
Floodplain	SS-166	8/7/2018	0.17-0.67 ft BGS	410	1	450	1	820	1	64	1	72	1	31
Floodplain	SS-167	8/7/2018	0.67-2.17 ft BGS	38	1	43	1	50	1	20	0	0.71	0	14
Floodplain	SS-167	8/7/2018	0.17-0.67 ft BGS	130	1	110	1	160	1	20	0	0.71	0	14
Floodplain	SS-168	8/7/2018	0.67-2.17 ft BGS	290	1	340	1	600	1	32	1	59	1	16
Floodplain	SS-168	8/7/2018	0.17-0.67 ft BGS	260	1	320	1	630	1	34	1	50	1	17
Floodplain	SS-169	8/7/2018	0.67-2.17 ft BGS	500	1	570	1	1000	1	85	1	0.83	0	30
Floodplain	SS-169	8/7/2018	0.17-0.67 ft BGS	520	1	590	1	1100	1	72	1	88	1	22
Floodplain	SS-170	8/7/2018	0.67-2.17 ft BGS	820	1	850	1	1400	1	180	1	190	1	94
Floodplain	SS-170	8/7/2018	0.17-0.67 ft BGS	540	1	610	1	1100	1	77	1	86	1	25
Floodplain	SS-171	8/7/2018	0.67-2.17 ft BGS	1900	1	1600	1	2700	1	280	1	190	1	89
Floodplain	SS-171	8/7/2018	0.17-0.67 ft BGS	690	1	750	1	1400	1	110	1	110	1	39
Floodplain	SS-172	8/7/2018	0.67-2.17 ft BGS	390	1	430	1	860	1	54	1	0.8	0	17
Floodplain	SS-172	8/7/2018	0.17-0.67 ft BGS	380	1	430	1	870	1	56	1	0.8	0	16
Floodplain	SS-173	8/8/2018	0.67-2.17 ft BGS	510	1	580	1	790	1	57	1	76	1	29
Floodplain	SS-173	8/8/2018	0.17-0.67 ft BGS	960	1	1000	1	1500	1	250	1	110	1	100
Floodplain	SS-174	8/8/2018	0.67-2.17 ft BGS	680	1	845	1	1350	1	98	1	114.5	1	47
Floodplain	SS-174	8/8/2018	0.17-0.67 ft BGS	590	1	820	1	1200	1	81	1	110	1	32
Floodplain	SS-175	8/8/2018	0.67-2.17 ft BGS	100	1	130	1	190	1	23	0	17	1	16
Floodplain	SS-175	8/8/2018	0.17-0.67 ft BGS	520	1	610	1	980	1	95	0	3.3	0	65

Table B.27.3

Summary of ProUCL Input Data for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				11	12	13	14	15	16	17	18	19	20	21	22	23	24
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	D_Dibenzofuran	Aluminum	D_Aluminum	Arsenic	D_Arsenic	Chromium VI (hexavalent)	D_Chromium VI (hexavalent)	Cobalt	D_Cobalt	Iron	D_Iron	Manganese	D_Manganese	Thallium
Floodplain	SS-164	8/6/2018	0.67-2.17 ft BGS	0	6000	1	5.4	1	0.52	1	4.6	1	12000	1	440	1	0.16
Floodplain	SS-164	8/6/2018	0.17-0.67 ft BGS	1	6200	1	8	1	0.53	0	5.4	1	14000	1	450	1	0.2
Floodplain	SS-165	8/6/2018	0.67-2.17 ft BGS	1	5000	1	11	1	0.59	0	4.4	1	12000	1	690	1	0.15
Floodplain	SS-165	8/6/2018	0.17-0.67 ft BGS	0	5000	1	7.55	1	0.55	0	4.25	1	11500	1	500	1	0.15
Floodplain	SS-166	8/7/2018	0.67-2.17 ft BGS	0	8500	1	10	1	0.3	0	6.6	1	16000	1	550	1	0.27
Floodplain	SS-166	8/7/2018	0.17-0.67 ft BGS	1	7500	1	9.8	1	1.5	0	5.8	1	14000	1	470	1	0.28
Floodplain	SS-167	8/7/2018	0.67-2.17 ft BGS	0	3900	1	6.3	1	0.36	1	3.3	1	8700	1	320	1	0.18
Floodplain	SS-167	8/7/2018	0.17-0.67 ft BGS	0	4900	1	8.9	1	0.26	0	3.9	1	11000	1	390	1	0.11
Floodplain	SS-168	8/7/2018	0.67-2.17 ft BGS	0	14000	1	12	1	0.61	0	9.7	1	25000	1	610	1	0.49
Floodplain	SS-168	8/7/2018	0.17-0.67 ft BGS	0	12000	1	10	1	0.62	0	9.1	1	24000	1	650	1	0.4
Floodplain	SS-169	8/7/2018	0.67-2.17 ft BGS	1	11000	1	10	1	0.76	1	8.5	1	22000	1	610	1	0.4
Floodplain	SS-169	8/7/2018	0.17-0.67 ft BGS	1	8600	1	7.7	1	0.59	0	6.6	1	17000	1	520	1	0.3
Floodplain	SS-170	8/7/2018	0.67-2.17 ft BGS	1	9000	1	8.9	1	0.43	1	7.3	1	18000	1	550	1	0.33
Floodplain	SS-170	8/7/2018	0.17-0.67 ft BGS	1	7600	1	9.2	1	0.6	0	6.2	1	16000	1	500	1	0.28
Floodplain	SS-171	8/7/2018	0.67-2.17 ft BGS	1	6900	1	7.2	1	0.42	1	5.8	1	16000	1	470	1	0.23
Floodplain	SS-171	8/7/2018	0.17-0.67 ft BGS	1	7400	1	7.3	1	0.59	0	6.3	1	17000	1	520	1	0.28
Floodplain	SS-172	8/7/2018	0.67-2.17 ft BGS	1	9700	1	8.6	1	0.58	0	7.5	1	19000	1	560	1	0.34
Floodplain	SS-172	8/7/2018	0.17-0.67 ft BGS	1	7900	1	6.8	1	0.58	0	6.1	1	16000	1	460	1	0.26
Floodplain	SS-173	8/8/2018	0.67-2.17 ft BGS	1	4300	1	4.8	1	0.55	1	3.5	1	9300	1	350	1	0.15
Floodplain	SS-173	8/8/2018	0.17-0.67 ft BGS	1	8100	1	7.2	1	0.57	0	5.9	1	15000	1	500	1	0.27
Floodplain	SS-174	8/8/2018	0.67-2.17 ft BGS	1	4900	1	4.75	1	0.565	0	3.8	1	10000	1	380	1	0.17
Floodplain	SS-174	8/8/2018	0.17-0.67 ft BGS	0	7000	1	6.2	1	0.59	0	5.2	1	14000	1	510	1	0.24
Floodplain	SS-175	8/8/2018	0.67-2.17 ft BGS	0	4300	1	5.1	1	0.29	0	3.6	1	9300	1	360	1	0.13
Floodplain	SS-175	8/8/2018	0.17-0.67 ft BGS	0	7300	1	6.1	1	0.6	0	5	1	13000	1	410	1	0.23

Table B.27.3

Summary of ProUCL Input Data for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

				25	26	27	28	29
EU:	**Sample Location:**	**Sample Date:**	**Sample Depth:**	D_Thallium	Aroclor-1248 (PCB-1248)	D_Aroclor-1248 (PCB-1248)	Aroclor-1254 (PCB-1254)	D_Aroclor-1254 (PCB-1254)
Floodplain	SS-164	8/6/2018	0.67-2.17 ft BGS	1	33	0	57	1
Floodplain	SS-164	8/6/2018	0.17-0.67 ft BGS	1	27	0	280	1
Floodplain	SS-165	8/6/2018	0.67-2.17 ft BGS	1	29	0	28	0
Floodplain	SS-165	8/6/2018	0.17-0.67 ft BGS	1	27.5	0	26	0
Floodplain	SS-166	8/7/2018	0.67-2.17 ft BGS	1	28	0	39	1
Floodplain	SS-166	8/7/2018	0.17-0.67 ft BGS	1	31	0	95	1
Floodplain	SS-167	8/7/2018	0.67-2.17 ft BGS	1	25	0	24	0
Floodplain	SS-167	8/7/2018	0.17-0.67 ft BGS	1	27	0	26	0
Floodplain	SS-168	8/7/2018	0.67-2.17 ft BGS	1	30	0	440	1
Floodplain	SS-168	8/7/2018	0.17-0.67 ft BGS	1	32	0	56	1
Floodplain	SS-169	8/7/2018	0.67-2.17 ft BGS	1	4600	1	290	0
Floodplain	SS-169	8/7/2018	0.17-0.67 ft BGS	1	30	0	110	1
Floodplain	SS-170	8/7/2018	0.67-2.17 ft BGS	1	150	0	860	1
Floodplain	SS-170	8/7/2018	0.17-0.67 ft BGS	1	29	0	79	1
Floodplain	SS-171	8/7/2018	0.67-2.17 ft BGS	1	28	0	150	1
Floodplain	SS-171	8/7/2018	0.17-0.67 ft BGS	1	31	0	65	1
Floodplain	SS-172	8/7/2018	0.67-2.17 ft BGS	1	30	0	70	1
Floodplain	SS-172	8/7/2018	0.17-0.67 ft BGS	1	28	0	60	1
Floodplain	SS-173	8/8/2018	0.67-2.17 ft BGS	1	26	0	360	1
Floodplain	SS-173	8/8/2018	0.17-0.67 ft BGS	1	30	0	110	1
Floodplain	SS-174	8/8/2018	0.67-2.17 ft BGS	1	29.5	0	58	1
Floodplain	SS-174	8/8/2018	0.17-0.67 ft BGS	1	30	0	51	1
Floodplain	SS-175	8/8/2018	0.67-2.17 ft BGS	1	29	0	120	1
Floodplain	SS-175	8/8/2018	0.17-0.67 ft BGS	1	30	0	300	1

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	42	Number of Distinct Observations	34
		Number of Missing Observations	0
Minimum	38	Mean	517.4
Maximum	1900	Median	505
SD	324.9	Std. Error of Mean	50.14
Coefficient of Variation	0.628	Skewness	1.736

Normal GOF Test

Shapiro Wilk Test Statistic	0.847	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.107	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	601.8	95% Adjusted-CLT UCL (Chen-1995)	614.2
		95% Modified-t UCL (Johnson-1978)	604

Gamma GOF Test

A-D Test Statistic	1.197	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.759	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.166	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.138	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.204	k star (bias corrected MLE)	2.062
Theta hat (MLE)	234.8	Theta star (bias corrected MLE)	250.9
nu hat (MLE)	185.1	nu star (bias corrected)	173.2
MLE Mean (bias corrected)	517.4	MLE Sd (bias corrected)	360.3
		Approximate Chi Square Value (0.05)	143.8
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	142.8

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	623.3	95% Adjusted Gamma UCL (use when n<50)	627.5

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.84	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.2	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.638	Mean of logged Data	6.005
Maximum of Logged Data	7.55	SD of logged Data	0.823

Assuming Lognormal Distribution

95% H-UCL	752.2	90% Chebyshev (MVUE) UCL	803.4
95% Chebyshev (MVUE) UCL	912.3	97.5% Chebyshev (MVUE) UCL	1063
99% Chebyshev (MVUE) UCL	1360		

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	599.9	95% Jackknife UCL	601.8
95% Standard Bootstrap UCL	598.3	95% Bootstrap-t UCL	617.4
95% Hall's Bootstrap UCL	647.7	95% Percentile Bootstrap UCL	601.6
95% BCA Bootstrap UCL	610.8		
90% Chebyshev(Mean, Sd) UCL	667.8	95% Chebyshev(Mean, Sd) UCL	736
97.5% Chebyshev(Mean, Sd) UCL	830.5	99% Chebyshev(Mean, Sd) UCL	1016

Suggested UCL to Use

95% Student's-t UCL	601.8

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene

General Statistics

Total Number of Observations	42	Number of Distinct Observations	36
		Number of Missing Observations	0
Minimum	43	Mean	550.9
Maximum	1600	Median	575
SD	304.8	Std. Error of Mean	47.03
Coefficient of Variation	0.553	Skewness	0.681

Normal GOF Test

Shapiro Wilk Test Statistic	0.909	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.0918	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	630	95% Adjusted-CLT UCL (Chen-1995)	633.5
		95% Modified-t UCL (Johnson-1978)	630.8

Gamma GOF Test

A-D Test Statistic	1.526	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.758	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.168	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.138	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.336	k star (bias corrected MLE)	2.185
Theta hat (MLE)	235.8	Theta star (bias corrected MLE)	252.1
nu hat (MLE)	196.3	nu star (bias corrected)	183.6
MLE Mean (bias corrected)	550.9	MLE Sd (bias corrected)	372.6
		Approximate Chi Square Value (0.05)	153.2
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	152.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	659.9	95% Adjusted Gamma UCL (use when n<50)	664.2

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.817	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.205	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.761	Mean of logged Data	6.082
Maximum of Logged Data	7.378	SD of logged Data	0.812

Assuming Lognormal Distribution

95% H-UCL	801.4	90% Chebyshev (MVUE) UCL	856.6
95% Chebyshev (MVUE) UCL	971.4	97.5% Chebyshev (MVUE) UCL	1131
99% Chebyshev (MVUE) UCL	1444		

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)pyrene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	628.2	95% Jackknife UCL	630
95% Standard Bootstrap UCL	628.8	95% Bootstrap-t UCL	634.2
95% Hall's Bootstrap UCL	643.1	95% Percentile Bootstrap UCL	627.4
95% BCA Bootstrap UCL	643		
90% Chebyshev(Mean, Sd) UCL	692	95% Chebyshev(Mean, Sd) UCL	755.9
97.5% Chebyshev(Mean, Sd) UCL	844.6	99% Chebyshev(Mean, Sd) UCL	1019

Suggested UCL to Use

95% Student's-t UCL	630

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	42	Number of Distinct Observations	31
		Number of Missing Observations	0
Minimum	50	Mean	916.5
Maximum	2700	Median	960
SD	511.9	Std. Error of Mean	78.98
Coefficient of Variation	0.558	Skewness	0.672

Normal GOF Test

Shapiro Wilk Test Statistic	0.904	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.102	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	1049	95% Adjusted-CLT UCL (Chen-1995)	1055
		95% Modified-t UCL (Johnson-1978)	1051

Gamma GOF Test

A-D Test Statistic	2.009	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.759	Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.209	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.138	Data Not Gamma Distributed at 5% Significance Level

Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	2.127	k star (bias corrected MLE)	1.991
Theta hat (MLE)	431	Theta star (bias corrected MLE)	460.4
nu hat (MLE)	178.6	nu star (bias corrected)	167.2
MLE Mean (bias corrected)	916.5	MLE Sd (bias corrected)	649.6
		Approximate Chi Square Value (0.05)	138.3
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	137.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	1108	95% Adjusted Gamma UCL (use when n<50)	1116

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.79	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.25	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Lognormal at 5% Significance Level

Data Not Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	3.912	Mean of logged Data	6.567
Maximum of Logged Data	7.901	SD of logged Data	0.88

Assuming Lognormal Distribution

95% H-UCL	1424	90% Chebyshev (MVUE) UCL	1514
95% Chebyshev (MVUE) UCL	1730	97.5% Chebyshev (MVUE) UCL	2031
99% Chebyshev (MVUE) UCL	2622		

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(b)fluoranthene (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	1046	95% Jackknife UCL	1049
95% Standard Bootstrap UCL	1051	95% Bootstrap-t UCL	1066
95% Hall's Bootstrap UCL	1073	95% Percentile Bootstrap UCL	1045
95% BCA Bootstrap UCL	1057		
90% Chebyshev(Mean, Sd) UCL	1154	95% Chebyshev(Mean, Sd) UCL	1261
97.5% Chebyshev(Mean, Sd) UCL	1410	99% Chebyshev(Mean, Sd) UCL	1702

Suggested UCL to Use

95% Student's-t UCL	1049

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole

General Statistics

Total Number of Observations	42	Number of Distinct Observations	33
Number of Detects	34	Number of Non-Detects	8
Number of Distinct Detects	28	Number of Distinct Non-Detects	5
Minimum Detect	32	Minimum Non-Detect	20
Maximum Detect	280	Maximum Non-Detect	95
Variance Detects	3012	Percent Non-Detects	19.05%
Mean Detects	93.18	SD Detects	54.88
Median Detects	82.5	CV Detects	0.589
Skewness Detects	1.944	Kurtosis Detects	4.525
Mean of Logged Detects	4.399	SD of Logged Detects	0.515

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.812	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.933	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.203	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.15	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	79.96	KM Standard Error of Mean	8.796
KM SD	56.04	95% KM (BCA) UCL	95.09
95% KM (t) UCL	94.77	95% KM (Percentile Bootstrap) UCL	94.15
95% KM (z) UCL	94.43	95% KM Bootstrap t UCL	98.58
90% KM Chebyshev UCL	106.4	95% KM Chebyshev UCL	118.3
97.5% KM Chebyshev UCL	134.9	99% KM Chebyshev UCL	167.5

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.509	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.131	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.152	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.861	k star (bias corrected MLE)	3.54
Theta hat (MLE)	24.13	Theta star (bias corrected MLE)	26.32
nu hat (MLE)	262.5	nu star (bias corrected)	240.7
Mean (detects)	93.18		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	77.49
Maximum	280	Median	69.75
SD	59.43	CV	0.767
k hat (MLE)	0.743	k star (bias corrected MLE)	0.706
Theta hat (MLE)	104.3	Theta star (bias corrected MLE)	109.8
nu hat (MLE)	62.4	nu star (bias corrected)	59.27
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (59.27, α)	42.57	Adjusted Chi Square Value (59.27, β)	42.07
95% Gamma Approximate UCL (use when n>=50)	107.9	95% Gamma Adjusted UCL (use when n<50)	109.2

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Carbazole (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	79.96	SD (KM)	56.04
Variance (KM)	3141	SE of Mean (KM)	8.796
k hat (KM)	2.036	k star (KM)	1.906
nu hat (KM)	171	nu star (KM)	160.1
theta hat (KM)	39.28	theta star (KM)	41.94
80% gamma percentile (KM)	120.4	90% gamma percentile (KM)	157.3
95% gamma percentile (KM)	192.6	99% gamma percentile (KM)	271.1

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (160.14, α)	131.9	Adjusted Chi Square Value (160.14, β)	131
95% Gamma Approximate KM-UCL (use when n>=50)	97.1	95% Gamma Adjusted KM-UCL (use when n<50)	97.77

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.97	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.933	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.103	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.15	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	80.99	Mean in Log Scale	4.198
SD in Original Scale	55.53	SD in Log Scale	0.633
95% t UCL (assumes normality of ROS data)	95.41	95% Percentile Bootstrap UCL	95.76
95% BCA Bootstrap UCL	98.96	95% Bootstrap t UCL	99.95
95% H-UCL (Log ROS)	99.11		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.151	KM Geo Mean	63.5
KM SD (logged)	0.7	95% Critical H Value (KM-Log)	2.06
KM Standard Error of Mean (logged)	0.11	95% H-UCL (KM -Log)	101.6
KM SD (logged)	0.7	95% Critical H Value (KM-Log)	2.06
KM Standard Error of Mean (logged)	0.11		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	78.46	Mean in Log Scale	4.059
SD in Original Scale	58.26	SD in Log Scale	0.874
95% t UCL (Assumes normality)	93.59	95% H-Stat UCL	114.9

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	97.77	95% GROS Adjusted Gamma UCL	109.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene

General Statistics

Total Number of Observations	42	Number of Distinct Observations	34
Number of Detects	33	Number of Non-Detects	9
Number of Distinct Detects	27	Number of Distinct Non-Detects	7
Minimum Detect	13	Minimum Non-Detect	0.71
Maximum Detect	190	Maximum Non-Detect	3.3
Variance Detects	1817	Percent Non-Detects	21.43%
Mean Detects	80.2	SD Detects	42.62
Median Detects	70	CV Detects	0.531
Skewness Detects	0.964	Kurtosis Detects	0.938
Mean of Logged Detects	4.235	SD of Logged Detects	0.592

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.921	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.931	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.152	Detected Data Not Normal at 5% Significance Level	

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	63.16	KM Standard Error of Mean	7.753
KM SD	49.48	95% KM (BCA) UCL	75.55
95% KM (t) UCL	76.21	95% KM (Percentile Bootstrap) UCL	75.87
95% KM (z) UCL	75.92	95% KM Bootstrap t UCL	77.53
90% KM Chebyshev UCL	86.42	95% KM Chebyshev UCL	96.96
97.5% KM Chebyshev UCL	111.6	99% KM Chebyshev UCL	140.3

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.354	**Anderson-Darling GOF Test**	
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.104	**Kolmogorov-Smirnov GOF**	
5% K-S Critical Value	0.154	Detected data appear Gamma Distributed at 5% Significance Level	

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	3.506	k star (bias corrected MLE)	3.208
Theta hat (MLE)	22.87	Theta star (bias corrected MLE)	25
nu hat (MLE)	231.4	nu star (bias corrected)	211.7
Mean (detects)	80.2		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	3.759	Mean	65.06
Maximum	190	Median	59.75
SD	47.76	CV	0.734
k hat (MLE)	1.443	k star (bias corrected MLE)	1.356
Theta hat (MLE)	45.09	Theta star (bias corrected MLE)	47.99
nu hat (MLE)	121.2	nu star (bias corrected)	113.9
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (113.88, α)	90.25	Adjusted Chi Square Value (113.88, β)	89.5
95% Gamma Approximate UCL (use when n>=50)	82.1	95% Gamma Adjusted UCL (use when n<50)	82.79

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Dibenz(a,h)anthracene (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	63.16	SD (KM)	49.48
Variance (KM)	2448	SE of Mean (KM)	7.753
k hat (KM)	1.63	k star (KM)	1.529
nu hat (KM)	136.9	nu star (KM)	128.5
theta hat (KM)	38.76	theta star (KM)	41.3
80% gamma percentile (KM)	97.52	90% gamma percentile (KM)	131
95% gamma percentile (KM)	163.5	99% gamma percentile (KM)	236.7

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (128.46, α)	103.3	Adjusted Chi Square Value (128.46, β)	102.5
95% Gamma Approximate KM-UCL (use when n>=50)	78.56	95% Gamma Adjusted KM-UCL (use when n<50)	79.18

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.944	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.931	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.13	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.152	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	67.28	Mean in Log Scale	3.967
SD in Original Scale	45.23	SD in Log Scale	0.739
95% t UCL (assumes normality of ROS data)	79.02	95% Percentile Bootstrap UCL	79.36
95% BCA Bootstrap UCL	79.86	95% Bootstrap t UCL	81.2
95% H-UCL (Log ROS)	88.38		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.254	KM Geo Mean	25.9
KM SD (logged)	1.948	95% Critical H Value (KM-Log)	3.578
KM Standard Error of Mean (logged)	0.305	95% H-UCL (KM -Log)	513.2
KM SD (logged)	1.948	95% Critical H Value (KM-Log)	3.578
KM Standard Error of Mean (logged)	0.305		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	63.13	Mean in Log Scale	3.162
SD in Original Scale	50.12	SD in Log Scale	2.154
95% t UCL (Assumes normality)	76.14	95% H-Stat UCL	885.6

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Gamma Distributed at 5% Significance Level

Suggested UCL to Use

95% KM Adjusted Gamma UCL	79.18	95% GROS Adjusted Gamma UCL	82.79

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum

General Statistics

Total Number of Observations	42	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	2100	Mean	6202
Maximum	14000	Median	5300
SD	2634	Std. Error of Mean	406.4
Coefficient of Variation	0.425	Skewness	0.899

Normal GOF Test

Shapiro Wilk Test Statistic	0.895	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	6886	95% Adjusted-CLT UCL (Chen-1995)	6931
		95% Modified-t UCL (Johnson-1978)	6896

Gamma GOF Test

A-D Test Statistic	0.335	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.143	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.137	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.946	k star (bias corrected MLE)	5.538
Theta hat (MLE)	1043	Theta star (bias corrected MLE)	1120
nu hat (MLE)	499.5	nu star (bias corrected)	465.2
MLE Mean (bias corrected)	6202	MLE Sd (bias corrected)	2636
		Approximate Chi Square Value (0.05)	416.1
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	414.5

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	6933	95% Adjusted Gamma UCL (use when n<50)	6960

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.935	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.119	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	7.65	Mean of logged Data	8.646
Maximum of Logged Data	9.547	SD of logged Data	0.425

Assuming Lognormal Distribution

95% H-UCL	7041	90% Chebyshev (MVUE) UCL	7480
95% Chebyshev (MVUE) UCL	8055	97.5% Chebyshev (MVUE) UCL	8851
99% Chebyshev (MVUE) UCL	10416		

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aluminum (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	6871	95% Jackknife UCL	6886
95% Standard Bootstrap UCL	6857	95% Bootstrap-t UCL	6990
95% Hall's Bootstrap UCL	6930	95% Percentile Bootstrap UCL	6926
95% BCA Bootstrap UCL	6913		
90% Chebyshev(Mean, Sd) UCL	7422	95% Chebyshev(Mean, Sd) UCL	7974
97.5% Chebyshev(Mean, Sd) UCL	8741	99% Chebyshev(Mean, Sd) UCL	10246

Suggested UCL to Use

95% Adjusted Gamma UCL	6960

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic

General Statistics

Total Number of Observations	42	Number of Distinct Observations	34
		Number of Missing Observations	0
Minimum	2.1	Mean	6.425
Maximum	12	Median	6.15
SD	2.454	Std. Error of Mean	0.379
Coefficient of Variation	0.382	Skewness	0.363

Normal GOF Test

Shapiro Wilk Test Statistic	0.908	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.138	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	7.062	95% Adjusted-CLT UCL (Chen-1995)	7.07
		95% Modified-t UCL (Johnson-1978)	7.066

Gamma GOF Test

A-D Test Statistic	0.4	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.751	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.109	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.137	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	6.676	k star (bias corrected MLE)	6.215
Theta hat (MLE)	0.962	Theta star (bias corrected MLE)	1.034
nu hat (MLE)	560.8	nu star (bias corrected)	522.1
MLE Mean (bias corrected)	6.425	MLE Sd (bias corrected)	2.577
		Approximate Chi Square Value (0.05)	470.1
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	468.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	7.136	95% Adjusted Gamma UCL (use when n<50)	7.162

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.914	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.108	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.742	Mean of logged Data	1.783
Maximum of Logged Data	2.485	SD of logged Data	0.409

Assuming Lognormal Distribution

95% H-UCL	7.274	90% Chebyshev (MVUE) UCL	7.716
95% Chebyshev (MVUE) UCL	8.288	97.5% Chebyshev (MVUE) UCL	9.081
99% Chebyshev (MVUE) UCL	10.64		

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Arsenic (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	7.048	95% Jackknife UCL	7.062
95% Standard Bootstrap UCL	7.04	95% Bootstrap-t UCL	7.092
95% Hall's Bootstrap UCL	7.049	95% Percentile Bootstrap UCL	7.074
95% BCA Bootstrap UCL	7.068		
90% Chebyshev(Mean, Sd) UCL	7.561	95% Chebyshev(Mean, Sd) UCL	8.075
97.5% Chebyshev(Mean, Sd) UCL	8.789	99% Chebyshev(Mean, Sd) UCL	10.19

Suggested UCL to Use

95% Adjusted Gamma UCL	7.162

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent)

General Statistics

Total Number of Observations	42	Number of Distinct Observations	28
Number of Detects	8	Number of Non-Detects	34
Number of Distinct Detects	8	Number of Distinct Non-Detects	21
Minimum Detect	0.36	Minimum Non-Detect	0.26
Maximum Detect	0.81	Maximum Non-Detect	3.4
Variance Detects	0.0282	Percent Non-Detects	80.95%
Mean Detects	0.568	SD Detects	0.168
Median Detects	0.535	CV Detects	0.296
Skewness Detects	0.338	Kurtosis Detects	-1.552
Mean of Logged Detects	-0.605	SD of Logged Detects	0.298

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.924	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Normal at 5% Significance Level
Lilliefors Test Statistic	0.169	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Normal at 5% Significance Level

Detected Data appear Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.408	KM Standard Error of Mean	0.0409
KM SD	0.146	95% KM (BCA) UCL	0.483
95% KM (t) UCL	0.477	95% KM (Percentile Bootstrap) UCL	0.479
95% KM (z) UCL	0.476	95% KM Bootstrap t UCL	0.477
90% KM Chebyshev UCL	0.531	95% KM Chebyshev UCL	0.587
97.5% KM Chebyshev UCL	0.664	99% KM Chebyshev UCL	0.815

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.307	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.715	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.182	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.294	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	13.11	k star (bias corrected MLE)	8.277
Theta hat (MLE)	0.0433	Theta star (bias corrected MLE)	0.0686
nu hat (MLE)	209.8	nu star (bias corrected)	132.4
Mean (detects)	0.568		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.227	Mean	0.398
Maximum	0.81	Median	0.367
SD	0.128	CV	0.321
k hat (MLE)	11.57	k star (bias corrected MLE)	10.76
Theta hat (MLE)	0.0344	Theta star (bias corrected MLE)	0.037
nu hat (MLE)	972.1	nu star (bias corrected)	904
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (904.04, α)	835.2	Adjusted Chi Square Value (904.04, β)	832.9
95% Gamma Approximate UCL (use when n>=50)	0.431	95% Gamma Adjusted UCL (use when n<50)	0.432

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Chromium VI (hexavalent) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.408	SD (KM)	0.146
Variance (KM)	0.0214	SE of Mean (KM)	0.0409
k hat (KM)	7.808	k star (KM)	7.266
nu hat (KM)	655.9	nu star (KM)	610.3
theta hat (KM)	0.0523	theta star (KM)	0.0562
80% gamma percentile (KM)	0.527	90% gamma percentile (KM)	0.611
95% gamma percentile (KM)	0.685	99% gamma percentile (KM)	0.841

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (610.34, α)	554	Adjusted Chi Square Value (610.34, β)	552.1
95% Gamma Approximate KM-UCL (use when n>=50)	0.45	95% Gamma Adjusted KM-UCL (use when n<50)	0.451

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.939	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.818	Detected Data appear Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.164	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.283	Detected Data appear Lognormal at 5% Significance Level

Detected Data appear Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.409	Mean in Log Scale	-0.928
SD in Original Scale	0.118	SD in Log Scale	0.251
95% t UCL (assumes normality of ROS data)	0.439	95% Percentile Bootstrap UCL	0.44
95% BCA Bootstrap UCL	0.445	95% Bootstrap t UCL	0.447
95% H-UCL (Log ROS)	0.437		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	-0.955	KM Geo Mean	0.385
KM SD (logged)	0.342	95% Critical H Value (KM-Log)	1.798
KM Standard Error of Mean (logged)	0.105	95% H-UCL (KM -Log)	0.449
KM SD (logged)	0.342	95% Critical H Value (KM-Log)	1.798
KM Standard Error of Mean (logged)	0.105		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	0.474	Mean in Log Scale	-0.963
SD in Original Scale	0.4	SD in Log Scale	0.602
95% t UCL (Assumes normality)	0.578	95% H-Stat UCL	0.551

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Detected Data appear Normal Distributed at 5% Significance Level

Suggested UCL to Use

95% KM (t) UCL	0.477

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt

General Statistics

Total Number of Observations	42	Number of Distinct Observations	32
		Number of Missing Observations	0
Minimum	1.6	Mean	4.931
Maximum	9.7	Median	4.325
SD	1.839	Std. Error of Mean	0.284
Coefficient of Variation	0.373	Skewness	0.729

Normal GOF Test

Shapiro Wilk Test Statistic	0.902	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	5.408	95% Adjusted-CLT UCL (Chen-1995)	5.432
		95% Modified-t UCL (Johnson-1978)	5.414

Gamma GOF Test

A-D Test Statistic	0.406	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.75	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.119	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.137	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	7.51	k star (bias corrected MLE)	6.99
Theta hat (MLE)	0.657	Theta star (bias corrected MLE)	0.705
nu hat (MLE)	630.9	nu star (bias corrected)	587.1
MLE Mean (bias corrected)	4.931	MLE Sd (bias corrected)	1.865
		Approximate Chi Square Value (0.05)	531.9
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	530.1

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	5.443	95% Adjusted Gamma UCL (use when n<50)	5.462

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.931	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.0969	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	0.47	Mean of logged Data	1.527
Maximum of Logged Data	2.272	SD of logged Data	0.379

Assuming Lognormal Distribution

95% H-UCL	5.513	90% Chebyshev (MVUE) UCL	5.833
95% Chebyshev (MVUE) UCL	6.237	97.5% Chebyshev (MVUE) UCL	6.797
99% Chebyshev (MVUE) UCL	7.899		

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Cobalt (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	5.398	95% Jackknife UCL	5.408
95% Standard Bootstrap UCL	5.392	95% Bootstrap-t UCL	5.428
95% Hall's Bootstrap UCL	5.455	95% Percentile Bootstrap UCL	5.4
95% BCA Bootstrap UCL	5.413		
90% Chebyshev(Mean, Sd) UCL	5.782	95% Chebyshev(Mean, Sd) UCL	6.168
97.5% Chebyshev(Mean, Sd) UCL	6.703	99% Chebyshev(Mean, Sd) UCL	7.754

Suggested UCL to Use

95% Adjusted Gamma UCL	5.462

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron

General Statistics

Total Number of Observations	42	Number of Distinct Observations	23
		Number of Missing Observations	0
Minimum	5700	Mean	13056
Maximum	25000	Median	11750
SD	4527	Std. Error of Mean	698.5
Coefficient of Variation	0.347	Skewness	0.819

Normal GOF Test

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.151	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	14232	95% Adjusted-CLT UCL (Chen-1995)	14299
		95% Modified-t UCL (Johnson-1978)	14246

Gamma GOF Test

A-D Test Statistic	0.425	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.749	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.126	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.136	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	8.966	k star (bias corrected MLE)	8.341
Theta hat (MLE)	1456	Theta star (bias corrected MLE)	1565
nu hat (MLE)	753.1	nu star (bias corrected)	700.7
MLE Mean (bias corrected)	13056	MLE Sd (bias corrected)	4521
		Approximate Chi Square Value (0.05)	640.2
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	638.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	14288	95% Adjusted Gamma UCL (use when n<50)	14334

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.929	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.107	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	8.648	Mean of logged Data	9.42
Maximum of Logged Data	10.13	SD of logged Data	0.342

Assuming Lognormal Distribution

95% H-UCL	14395	90% Chebyshev (MVUE) UCL	15173
95% Chebyshev (MVUE) UCL	16131	97.5% Chebyshev (MVUE) UCL	17460
99% Chebyshev (MVUE) UCL	20071		

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Iron (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	14205	95% Jackknife UCL	14232
95% Standard Bootstrap UCL	14182	95% Bootstrap-t UCL	14342
95% Hall's Bootstrap UCL	14353	95% Percentile Bootstrap UCL	14213
95% BCA Bootstrap UCL	14217		
90% Chebyshev(Mean, Sd) UCL	15152	95% Chebyshev(Mean, Sd) UCL	16101
97.5% Chebyshev(Mean, Sd) UCL	17418	99% Chebyshev(Mean, Sd) UCL	20006

Suggested UCL to Use

95% Adjusted Gamma UCL	14334

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese

General Statistics

Total Number of Observations	42	Number of Distinct Observations	29
		Number of Missing Observations	0
Minimum	150	Mean	420.1
Maximum	690	Median	410
SD	127.6	Std. Error of Mean	19.7
Coefficient of Variation	0.304	Skewness	-0.0579

Normal GOF Test

Shapiro Wilk Test Statistic	0.933	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.0914	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Normal at 5% Significance Level

Data appear Approximate Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	453.3	95% Adjusted-CLT UCL (Chen-1995)	452.3
		95% Modified-t UCL (Johnson-1978)	453.2

Gamma GOF Test

A-D Test Statistic	0.427	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.748	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.104	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.136	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics

k hat (MLE)	9.691	k star (bias corrected MLE)	9.015
Theta hat (MLE)	43.35	Theta star (bias corrected MLE)	46.6
nu hat (MLE)	814	nu star (bias corrected)	757.2
MLE Mean (bias corrected)	420.1	MLE Sd (bias corrected)	139.9
		Approximate Chi Square Value (0.05)	694.4
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	692.2

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50))	458.1	95% Adjusted Gamma UCL (use when n<50)	459.6

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.893	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.101	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	5.011	Mean of logged Data	5.988
Maximum of Logged Data	6.537	SD of logged Data	0.345

Assuming Lognormal Distribution

95% H-UCL	466.2	90% Chebyshev (MVUE) UCL	491.5
95% Chebyshev (MVUE) UCL	522.8	97.5% Chebyshev (MVUE) UCL	566.2
99% Chebyshev (MVUE) UCL	651.5		

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Manganese (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	452.5	95% Jackknife UCL	453.3
95% Standard Bootstrap UCL	451.8	95% Bootstrap-t UCL	452.6
95% Hall's Bootstrap UCL	452	95% Percentile Bootstrap UCL	452.6
95% BCA Bootstrap UCL	451.3		
90% Chebyshev(Mean, Sd) UCL	479.2	95% Chebyshev(Mean, Sd) UCL	506
97.5% Chebyshev(Mean, Sd) UCL	543.1	99% Chebyshev(Mean, Sd) UCL	616.1

Suggested UCL to Use

95% Student's-t UCL	453.3

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Note: For highly negatively-skewed data, confidence limits (e.g., Chen, Johnson, Lognormal, and Gamma) may not be reliable. Chen's and Johnson's methods provide adjustments for positvely skewed data sets.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium

General Statistics

Total Number of Observations	42	Number of Distinct Observations	23
		Number of Missing Observations	0
Minimum	0.075	Mean	0.209
Maximum	0.49	Median	0.175
SD	0.0938	Std. Error of Mean	0.0145
Coefficient of Variation	0.449	Skewness	0.976

Normal GOF Test

Shapiro Wilk Test Statistic	0.875	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.176	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.135	Data Not Normal at 5% Significance Level

Data Not Normal at 5% Significance Level

Assuming Normal Distribution

95% Normal UCL		**95% UCLs (Adjusted for Skewness)**	
95% Student's-t UCL	0.233	95% Adjusted-CLT UCL (Chen-1995)	0.235
		95% Modified-t UCL (Johnson-1978)	0.234

Gamma GOF Test

A-D Test Statistic	0.549	**Anderson-Darling Gamma GOF Test**
5% A-D Critical Value	0.752	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.152	**Kolmogorov-Smirnov Gamma GOF Test**
5% K-S Critical Value	0.137	Data Not Gamma Distributed at 5% Significance Level

Detected data follow Appr. Gamma Distribution at 5% Significance Level

Gamma Statistics

k hat (MLE)	5.511	k star (bias corrected MLE)	5.133
Theta hat (MLE)	0.0379	Theta star (bias corrected MLE)	0.0407
nu hat (MLE)	462.9	nu star (bias corrected)	431.2
MLE Mean (bias corrected)	0.209	MLE Sd (bias corrected)	0.0922
		Approximate Chi Square Value (0.05)	384
Adjusted Level of Significance	0.0443	Adjusted Chi Square Value	382.4

Assuming Gamma Distribution

95% Approximate Gamma UCL (use when n>=50)	0.235	95% Adjusted Gamma UCL (use when n<50)	0.236

Lognormal GOF Test

Shapiro Wilk Test Statistic	0.925	**Shapiro Wilk Lognormal GOF Test**
5% Shapiro Wilk Critical Value	0.942	Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.131	**Lilliefors Lognormal GOF Test**
5% Lilliefors Critical Value	0.135	Data appear Lognormal at 5% Significance Level

Data appear Approximate Lognormal at 5% Significance Level

Lognormal Statistics

Minimum of Logged Data	-2.59	Mean of logged Data	-1.659
Maximum of Logged Data	-0.713	SD of logged Data	0.437

Assuming Lognormal Distribution

95% H-UCL	0.238	90% Chebyshev (MVUE) UCL	0.253
95% Chebyshev (MVUE) UCL	0.273	97.5% Chebyshev (MVUE) UCL	0.3
99% Chebyshev (MVUE) UCL	0.355		

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Thallium (cont.'d)

Nonparametric Distribution Free UCL Statistics
Data appear to follow a Discernible Distribution at 5% Significance Level

Nonparametric Distribution Free UCLs

95% CLT UCL	0.233	95% Jackknife UCL	0.233
95% Standard Bootstrap UCL	0.232	95% Bootstrap-t UCL	0.236
95% Hall's Bootstrap UCL	0.236	95% Percentile Bootstrap UCL	0.234
95% BCA Bootstrap UCL	0.232		
90% Chebyshev(Mean, Sd) UCL	0.252	95% Chebyshev(Mean, Sd) UCL	0.272
97.5% Chebyshev(Mean, Sd) UCL	0.299	99% Chebyshev(Mean, Sd) UCL	0.353

Suggested UCL to Use

95% Adjusted Gamma UCL	0.236

When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248)

General Statistics

Total Number of Observations	42	Number of Distinct Observations	17
Number of Detects	6	Number of Non-Detects	36
Number of Distinct Detects	5	Number of Distinct Non-Detects	13
Minimum Detect	50	Minimum Non-Detect	25
Maximum Detect	4600	Maximum Non-Detect	150
Variance Detects	3329067	Percent Non-Detects	85.71%
Mean Detects	876.7	SD Detects	1825
Median Detects	145	CV Detects	2.081
Skewness Detects	2.446	Kurtosis Detects	5.988
Mean of Logged Detects	5.405	SD of Logged Detects	1.551

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.519	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.482	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.325	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	146.8	KM Standard Error of Mean	117.7
KM SD	696.5	95% KM (BCA) UCL	368.8
95% KM (t) UCL	345	95% KM (Percentile Bootstrap) UCL	363.9
95% KM (z) UCL	340.5	95% KM Bootstrap t UCL	2413
90% KM Chebyshev UCL	500	95% KM Chebyshev UCL	660
97.5% KM Chebyshev UCL	882.1	99% KM Chebyshev UCL	1318

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.243	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.741	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.467	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.35	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.468	k star (bias corrected MLE)	0.345
Theta hat (MLE)	1872	Theta star (bias corrected MLE)	2540
nu hat (MLE)	5.618	nu star (bias corrected)	4.142
Mean (detects)	876.7		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	125.2
Maximum	4600	Median	0.01
SD	708.8	CV	5.659
k hat (MLE)	0.101	k star (bias corrected MLE)	0.11
Theta hat (MLE)	1237	Theta star (bias corrected MLE)	1139
nu hat (MLE)	8.508	nu star (bias corrected)	9.233
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (9.23, α)	3.469	Adjusted Chi Square Value (9.23, β)	3.343
95% Gamma Approximate UCL (use when n>=50)	333.4	95% Gamma Adjusted UCL (use when n<50)	345.9

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1248 (PCB-1248) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	146.8	SD (KM)	696.5
Variance (KM)	485112	SE of Mean (KM)	117.7
k hat (KM)	0.0444	k star (KM)	0.0571
nu hat (KM)	3.733	nu star (KM)	4.8
theta hat (KM)	3304	theta star (KM)	2570
80% gamma percentile (KM)	30.75	90% gamma percentile (KM)	262.6
95% gamma percentile (KM)	813.4	99% gamma percentile (KM)	3024

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (4.80, α)	1.061	Adjusted Chi Square Value (4.80, β)	1.001
95% Gamma Approximate KM-UCL (use when n>=50)	664.4	95% Gamma Adjusted KM-UCL (use when n<50)	704

95% Gamma Adjusted KM-UCL (use when k<=1 and 15 < n < 50)

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.74	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.788	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.388	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.325	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	126.6	Mean in Log Scale	0.00556
SD in Original Scale	708.6	SD in Log Scale	2.886
95% t UCL (assumes normality of ROS data)	310.6	95% Percentile Bootstrap UCL	344.2
95% BCA Bootstrap UCL	465.1	95% Bootstrap t UCL	2477
95% H-UCL (Log ROS)	606.3		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	3.534	KM Geo Mean	34.26
KM SD (logged)	0.935	95% Critical H Value (KM-Log)	2.287
KM Standard Error of Mean (logged)	0.158	95% H-UCL (KM -Log)	74.07
KM SD (logged)	0.935	95% Critical H Value (KM-Log)	2.287
KM Standard Error of Mean (logged)	0.158		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	139	Mean in Log Scale	3.097
SD in Original Scale	706.4	SD in Log Scale	1.128
95% t UCL (Assumes normality)	322.5	95% H-Stat UCL	64.89

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics
Data do not follow a Discernible Distribution at 5% Significance Level

Suggested UCL to Use

95% KM (Chebyshev) UCL	660

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254)

General Statistics

Total Number of Observations	42	Number of Distinct Observations	33
Number of Detects	30	Number of Non-Detects	12
Number of Distinct Detects	27	Number of Distinct Non-Detects	6
Minimum Detect	30	Minimum Non-Detect	24
Maximum Detect	860	Maximum Non-Detect	290
Variance Detects	28993	Percent Non-Detects	28.57%
Mean Detects	135.3	SD Detects	170.3
Median Detects	67.5	CV Detects	1.258
Skewness Detects	3.123	Kurtosis Detects	11.25
Mean of Logged Detects	4.496	SD of Logged Detects	0.816

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.594	**Shapiro Wilk GOF Test**
5% Shapiro Wilk Critical Value	0.927	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.312	**Lilliefors GOF Test**
5% Lilliefors Critical Value	0.159	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	104.5	KM Standard Error of Mean	23.57
KM SD	150	95% KM (BCA) UCL	149.2
95% KM (t) UCL	144.2	95% KM (Percentile Bootstrap) UCL	147.2
95% KM (z) UCL	143.3	95% KM Bootstrap t UCL	183.1
90% KM Chebyshev UCL	175.2	95% KM Chebyshev UCL	207.2
97.5% KM Chebyshev UCL	251.7	99% KM Chebyshev UCL	339

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	2.13	**Anderson-Darling GOF Test**
5% A-D Critical Value	0.767	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.205	**Kolmogorov-Smirnov GOF**
5% K-S Critical Value	0.163	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	1.358	k star (bias corrected MLE)	1.244
Theta hat (MLE)	99.67	Theta star (bias corrected MLE)	108.8
nu hat (MLE)	81.47	nu star (bias corrected)	74.65
Mean (detects)	135.3		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)
For such situations, GROS method may yield incorrect values of UCLs and BTVs
This is especially true when the sample size is small.
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	0.01	Mean	97.09
Maximum	860	Median	55.75
SD	155.8	CV	1.604
k hat (MLE)	0.279	k star (bias corrected MLE)	0.275
Theta hat (MLE)	348.1	Theta star (bias corrected MLE)	353.2
nu hat (MLE)	23.43	nu star (bias corrected)	23.09
Adjusted Level of Significance (β)	0.0443		
Approximate Chi Square Value (23.09, α)	13.16	Adjusted Chi Square Value (23.09, β)	12.89
95% Gamma Approximate UCL (use when n>=50)	170.4	95% Gamma Adjusted UCL (use when n<50)	173.9

Table B.27.4

Summary of ProUCL Output for Floodplain Surface Soil (0-2 ft BGS)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

User Selected Options	
Date/Time of Computation	ProUCL 5.11/7/2020 11:07:27 AM
From File	WorkSheet.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Aroclor-1254 (PCB-1254) (cont.'d)

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	104.5	SD (KM)	150
Variance (KM)	22492	SE of Mean (KM)	23.57
k hat (KM)	0.485	k star (KM)	0.467
nu hat (KM)	40.77	nu star (KM)	39.19
theta hat (KM)	215.3	theta star (KM)	223.9
80% gamma percentile (KM)	171	90% gamma percentile (KM)	286.7
95% gamma percentile (KM)	411.4	99% gamma percentile (KM)	720

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (39.19, α)	25.85	Adjusted Chi Square Value (39.19, β)	25.47
95% Gamma Approximate KM-UCL (use when n>=50)	158.4	95% Gamma Adjusted KM-UCL (use when n<50)	160.8

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.894	**Shapiro Wilk GOF Test**	
5% Shapiro Wilk Critical Value	0.927	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.153	**Lilliefors GOF Test**	
5% Lilliefors Critical Value	0.159	Detected Data appear Lognormal at 5% Significance Level	

Detected Data appear Approximate Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	101.7	Mean in Log Scale	4.003
SD in Original Scale	153.1	SD in Log Scale	1.071
95% t UCL (assumes normality of ROS data)	141.5	95% Percentile Bootstrap UCL	142.9
95% BCA Bootstrap UCL	158.8	95% Bootstrap t UCL	175.9
95% H-UCL (Log ROS)	146		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution

KM Mean (logged)	4.138	KM Geo Mean	62.68
KM SD (logged)	0.896	95% Critical H Value (KM-Log)	2.246
KM Standard Error of Mean (logged)	0.142	95% H-UCL (KM -Log)	128.2
KM SD (logged)	0.896	95% Critical H Value (KM-Log)	2.246
KM Standard Error of Mean (logged)	0.142		

DL/2 Statistics

DL/2 Normal		**DL/2 Log-Transformed**	
Mean in Original Scale	103.6	Mean in Log Scale	4.01
SD in Original Scale	153.2	SD in Log Scale	1.097
95% t UCL (Assumes normality)	143.4	95% H-Stat UCL	153.6

DL/2 is not a recommended method, provided for comparisons and historical reasons

Nonparametric Distribution Free UCL Statistics

Detected Data appear Approximate Lognormal Distributed at 5% Significance Level

Suggested UCL to Use

KM H-UCL	128.2

Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.
Recommendations are based upon data size, data distribution, and skewness.
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.

Appendix C
VISL Calculation for Indoor Air Concentrations

Table C.1

Summary of Soil Vapor Modelled to Indoor Air Exposure Point Concentrations (EPCs)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	EU3-EU4 Jim City		EU5-EU8 Barnett		EU9-EU15 Dryden Rd.	
	Soil Vapor EPC (1) ($\mu g/m^3$)	Modelled Indoor Air EPC (2) ($\mu g/m^3$)	Soil Vapor EPC (1) ($\mu g/m^3$)	Modelled Indoor Air EPC (2) ($\mu g/m^3$)	Soil Vapor EPC (1) ($\mu g/m^3$)	Modelled Indoor Air EPC (2) ($\mu g/m^3$)
Volatile Organic Compounds						
1,1-Dichloroethane	--	--	--	--	1.4E+03	4.3E+01
1,4-Dichlorobenzene	--	--	--	--	--	--
1,2,4-Trimethylbenzene	8.4E+03	2.5E+02	--	--	--	--
Benzene	1.1E+05	3.3E+03	--	--	--	--
Bromodichloromethane	--	--	--	--	--	--
Carbon tetrachloride	--	--	--	--	7.4E+00	2.2E-01
Chlorobenzene	--	--	--	--	--	--
Chloroform	--	--	--	--	4.0E+01	1.2E+00
Cyclohexane	2.3E+05	6.9E+03	--	--	--	--
Dichlorodifluoromethane	--	--	--	--	--	--
Ethylbenzene	1.4E+05	4.2E+03	--	--	--	--
Hexane	6.3E+05	1.9E+04	--	--	--	--
Isopropyl benzene (Cumene)	9.8E+03	2.9E+02	--	--	--	--
N-Heptane	1.1E+06	3.3E+04	--	--	--	--
Naphthalene	--	--	--	--	--	--
Tetrachloroethene	--	--	--	--	1.3E+02	3.9E+00
Toluene	1.7E+06	5.1E+04	--	--	--	--
Trichloroethene	--	--	6.9E+02	2.1E+01	2.0E+04	6.1E+02
Vinyl chloride	--	--	--	--	1.6E+02	4.8E+00
Xylenes	7.7E+05	2.3E+04	--	--	--	--

Notes:

(1) For soil vapor EPCs, refer to Appendix A.

(2) Soil vapor volatilizing to indoor air EPCs modelled using USEPA Vapor Intrusion Screening Levels (VISL) Calculator, November 2019 (https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator).

Table C.1

Summary of Soil Vapor Modelled to Indoor Air Exposure Point Concentrations (EPCs)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	EU16 Valley Asphalt		EU18-EU19 Central		Outside of OU1 - South	
	Soil Vapor EPC (1) ($\mu g/m^3$)	Modelled Indoor Air EPC (2) ($\mu g/m^3$)	Soil Vapor EPC (1) ($\mu g/m^3$)	Modelled Indoor Air EPC (2) ($\mu g/m^3$)	Soil Vapor EPC (1) ($\mu g/m^3$)	Modelled Indoor Air EPC (2) ($\mu g/m^3$)
Volatile Organic Compounds						
1,1-Dichloroethane	4.0E+02	1.2E+01	--	--	--	--
1,4-Dichlorobenzene	--	--	7.4E+01	2.2E+00	--	--
1,2,4-Trimethylbenzene	--	--	--	--	--	--
Benzene	1.4E+04	4.2E+02	3.5E+02	1.0E+01	--	--
Bromodichloromethane	--	--	--	--	5.3E+00	1.6E-01
Carbon tetrachloride	--	--	--	--	--	--
Chlorobenzene	1.1E+05	3.3E+03	2.7E+03	8.2E+01	--	--
Chloroform	--	--	1.4E+01	4.2E-01	2.6E+02	7.8E+00
Cyclohexane	5.0E+04	1.5E+03	--	--	--	--
Dichlorodifluoromethane	--	--	1.0E+03	3.1E+01	--	--
Ethylbenzene	4.8E+04	1.4E+03	1.6E+02	4.7E+00	--	--
Hexane	--	--	2.4E+03	7.1E+01	--	--
Isopropyl benzene (Cumene)	4.1E+03	1.2E+02	--	--	--	--
N-Heptane	1.6E+03	4.8E+01	1.3E+03	4.0E+01	--	--
Naphthalene	9.8E+02	2.9E+01	--	--	--	--
Tetrachloroethene	--	--	1.6E+02	4.9E+00	--	--
Toluene	--	--	--	--	--	--
Trichloroethene	3.6E+02	1.1E+01	4.7E+02	1.4E+01	--	--
Vinyl chloride	4.8E+03	1.4E+02	1.3E+02	3.9E+00	--	--
Xylenes	4.7E+04	1.4E+03	5.2E+02	1.6E+01	--	--

Notes:

(1) For soil vapor EPCs, refer to Appendix A.

(2) Soil vapor volatilizing to indoor air EPCs modelled using USEPA Vapor Intrusion Screening Levels (VISL) Calculator, November 2019 (https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator).

Table C.2

Summary of Groundwater Modelled to Indoor Air Exposure Point Concentrations (EPCs)
Risk Assessment Assumption Document (RAAD)
South Dayton Dump Site
Moraine, Ohio

Chemicals of Potential Concern	OU1 - Upper Aquifer	
	Groundwater EPC (1) (µg/L)	Modelled Indoor Air EPC (2) (µg/m^3)
Volatile Organic Compounds		
1,1-Dichloroethane	1.4E+00	3.2E-01
1,4-Dichlorobenzene	2.5E-01	2.5E-02
Benzene	5.2E+00	1.2E+00
Chloroform (Trichloromethane)	2.3E-01	3.5E-02
Ethylbenzene	3.9E+00	1.2E+00
Trichloroethene	1.1E+01	4.6E+00
Vinyl chloride	4.5E+00	5.1E+00
Xylenes (total)	6.2E-01	1.7E-01
Semi-Volatiles Organic Compounds		
Naphthalene	6.0E-01	1.1E-02
Metals		
Cyanide (total)	9.9E+01	4.1E-01
Mercury	1.6E-01	5.5E-02

Notes:

(1) For groundwater EPCs, refer to Appendix A.

(2) Groundwater volatilizing to indoor air EPCs modelled using USEPA Vapor Intrusion Screening Levels (VISL) Calculator, November 2019 (https://www.epa.gov/vaporintrusion/vapor-intrusion-screening-level-calculator).

Appendix D
USEPA 1999 Memorandum

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Ref: 8EPR-PS

To: Tracy Eagle, RPM Twins Inn

From: Helen Dawson, Ph.D., Hydrogeologist, Superfund Program Support

Date: July 29, 1999

Subject: Derivation of a volatilization factor to estimate upper bound exposure point concentration for workers in trenches flooded with ground water off-gassing volatile organic chemicals.

This memo presents the derivation of a volatilization factor that can be used to estimate the upper bound exposure point concentration for workers in trenches flooded with ground water off-gassing volatile organic chemicals (VOCs). The derivation is based on a mass balance equation developed using a well-mixed, single-compartment model, also referred to as a box model. This approach is commonly used to estimate air concentrations in enclosed spaces (Andelman, 1985). In this approach, the chemical concentration everywhere in the "box" (e.g., the trench air compartment) is assumed to be the same. The VOC enters the box through emission from ground water at the base of the trench, as shown in Figure 1, and leaves the box by wind-induced convection. This scenario was chosen because it is the more conservative of the possible scenarios for workers in trenches. A volatilization factor developed for a trench that intersects moist contaminated soil, rather than ground water, would yield lower exposure point concentrations in trench air, provided the pore water concentrations were equivalent to ground water concentrations, because the chemical emission rate would be reduced by the required diffusion through soil.

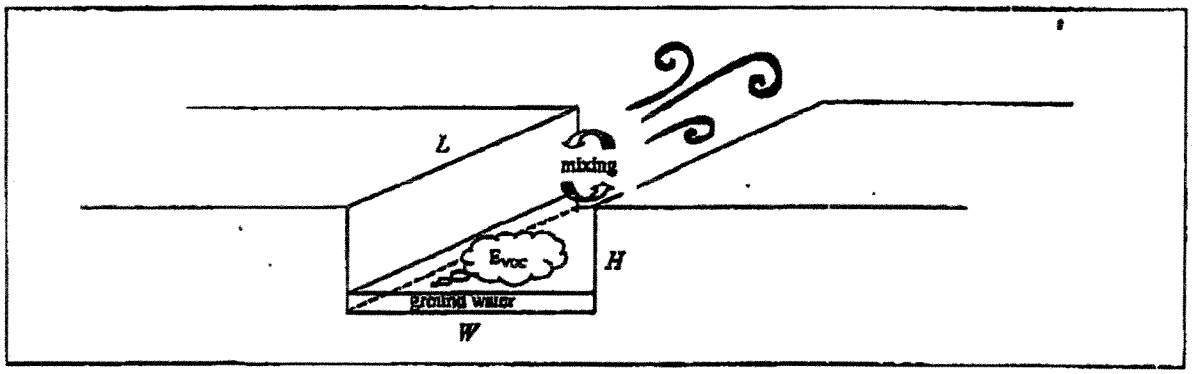

Figure 1. Scenario of exposure to workers in a trench flooded with VOC-contaminated ground water.

At steady state (a conservative assumption), the mass balance for the system depicted in Figure 1 is obtained by setting the emission rate (E) of chemical from water to air equal to the rate at which the chemical is carried away from the trench by exchange with the overlying air mass (after Schnoor, 1996, p.73; Andelman, 1985). Thus,

$$E_{VOC} = kNLWHC_a, \qquad (1)$$

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where E_{VOC} = emission rate of chemical from water to air [mg/sec],
k = mixing factor (deviation from complete mixing in real conditions) [unitless],
N = number of air exchanges per unit time in the trench [1/sec],
H = height of the trench [m],
L = length of the trench [m],
W = width of the trench [m], and
C_a = steady state, exposure point chemical concentration in trench air [mg/m^3].

Solving equation (1) can be for C_a yields

$$C_a = \frac{E_{VOC}}{kNLWH}. \quad (2)$$

In order to develop a volatilization factor for the scenario shown in Figure 1, an expression for E_{VOC} in terms of ground water concentration is needed. Guidance provided by the Superfund Exposure Assessment Manual (US EPA, 1988) recommends use of the following equation for volatilization from a surface water body to air:

$$E_{VOC} = k_{LG} A C_w, \quad (3)$$

where k_{LG} = overall mass transfer coefficient from the liquid phase to gas phase [m/sec],
A = surface area of water body (= LW) [m^2], and
C_w = chemical concentration in ground water (mg/l x 1000 l/m^3).

While ground water that has accumulated at the bottom of a trench is not strictly a surface water body, it can be considered a bulk liquid phase from which chemicals volatilize to air, which is the mechanism represented by equation (3). Thus, equation (3) is an appropriate model to apply in the scenario depicted in Figure 1. Substitution of equation (3) into equation (2) and canceling terms yields:

$$C_a = \left(\frac{k_{LG}}{kNH}\right)\left(\frac{1000\ \text{l}}{\text{m}^3}\right) C_w \quad (4)$$

Rearranging terms in equation (4) yields a volatilization factor (VF_{VOC}) for transfer of VOCs from ground water accumulations at the bottom of a trench to the air in the trench.

$$VF_{VOC}\left[\frac{\text{l-water}}{\text{m}^3\text{-air}}\right] = \frac{C_a\left[\text{mg/m}^3\right]}{C_w\left[\text{mg/l}\right]} = \frac{k_{LG}}{kNH}\left(\frac{1000\ \text{l}}{\text{m}^3}\right) \quad (5)$$

Equation (5) can be used to develop chemical specific volatilization factors for any volatile organic chemical. Alternately, a generic numeric VOC volatilization factor can be obtained by developing conservative estimates for k_{LG}, k, N and H, as described in the following paragraphs, that correspond to the scenario depicted in Figure 1.

The overall mass transfer coefficient k_{LG} is a function of the mass transfer coefficients for water and air on either side of the interface between the two phases, as shown in equation (6).

$$\frac{1}{k_{LG}} = \frac{1}{k_L} + \frac{RT}{H_c k_G}, \quad (6)$$

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where k_L = liquid phase mass transfer coefficient [m/sec],
k_G = gas phase mass transfer coefficient [m/sec],
R = ideal gas law constant (8.2×10^{-5} atm·m³/mol·K),
T = temperature (K),
H_C = Henry's Law constant (atm·m³/mol).

For volatile chemicals (i.e., Henry's Constant greater than 1×10^{-4} atm·m³·mol⁻¹), the liquid mass transfer coefficient (k_L) is typically five or more orders of magnitude smaller than the gas phase mass transfer coefficient (k_G) and, consequently, mass transfer from water to air is limited by rate of mass transfer through the liquid. Thus, for a VOC, the overall mass transfer coefficient for water-to-air transfer is approximately equal to its liquid mass transfer coefficient.

$$k_{LG} \cong k_L \tag{7}$$

Liquid mass transfer coefficients (k_L) at 25°C can be estimated from the liquid mass transfer coefficient for dissolved oxygen and the aqueous diffusion coefficient of the chemical (Schwarzenbach et al, 1993), e.g.,

$$k_L = k_{L,oxy}\sqrt{\frac{D_{VOC}}{D_{oxy}}}, \tag{8}$$

where $k_{L,oxy}$ = liquid phase mass transfer coefficient for dissolved oxygen [m/sec],
D_{VOC} = aqueous diffusion coefficient of the dissolved VOC [m²/sec], and
D_{oxy} = aqueous diffusion coefficient of dissolved oxygen [m²/sec].

The liquid mass transfer coefficient for dissolved oxygen is a function of wind speed and is calculated as (Schwarzenbach et al, 1993):

$$k_{L,oxy} = 4.0 \times 10^{-6} + 4.0 \times 10^{-7}\, u \tag{9}$$

where u = wind speed 10 m above the water surface [m/sec].

The concentration of volatile organic chemicals in the trench will be highest on calm days, which corresponds to a wind speed of < 1 mph (Beaufort Wind Scale). Using this wind speed, the liquid mass transfer coefficient for dissolved oxygen is 4.2×10^{-6} m/sec.

For volatile organic chemicals, a conservative (large) estimate of D_{VOC} is 1.1×10^{-9} m²/sec. For oxygen, the diffusion coefficient at ambient temperature (25°C) is 2.1×10^{-9} m²/sec (Cussler, 1997). Applying these values to equations (7) and (8) yields a conservative (large) estimate for k_{LG} of 3.0×10^{-6} m/sec. This is equivalent to the conservative value obtained for volatile chemicals of concern at the Twins Inn site using the approach described in the US EPA Superfund Exposure Assessment Manual (1988), which is based on a ratio of molecular weights.

The number of air changes per day (N) in the trench can be estimated from the wind speed and the length of the trench, assuming (in the worst case) the long axis of the trench is parallel to the wind direction:

$$N = \frac{u}{L} \tag{10}$$

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Assuming construction of a commercial building requires a trench length up to 30 m and using a calm wind speed of 1 mph (0.45 m/sec), the number of air changes per day is conservatively estimated to be 0.015/sec. This value assumes uniform mixing in the trench. In homes, the proportion of the well-mixed volume to total volume ranges from 0.1 to 0.3 (i.e., the "dead" space not subject to complete mixing is approximately 70% to 90% of the total volume) (Andelman, 1985). Mixing is likely to be closer to complete mixing in an open trench, thus a value of 50% ($k = 0.5$) is assumed.

When applied to equation (5), the values calculated or assumed above for k_{LG}, k, N, and assuming the maximum trench depth (H) is 3 m, yield a conservative numeric VOC volatilization factor for the scenario shown in Figure 1.

$$VF_{voc}\left[\frac{l-water}{m^3-air}\right] = \frac{\left(3x10^{-4}m/sec\right)}{(0.5)(0.015/sec)(3m)}\left(\frac{1000\,l}{m^3}\right) = 0.133 \qquad (11)$$

This calculated value is appropriate only for VOCs with Henry's Constants greater than $1x10^{-4}$ atm-m^3-mol^{-1}. Multiplying the volatilization factor by ground water concentration yields a conservative estimate of the air concentration to which workers in trenches with groundwater off-gassing VOCs could be exposed.

The generic VOC volatilization factor calculated in equation (11) is approximately 20% of the generic value calculated by Andelman (1985) for volatilization of VOCs in typical indoor water use for a family of four. This result is expected, as the mechanism for volatilization in a flooded outdoor trench is considerably less vigorous than that responsible for volatilization in typical indoor water use (e.g., showering), resulting in lower emission rates in the trench relative to an indoor scenario. However, the smaller volume of the trench, which has the effect of increasing concentration, counters the effect of the lower emission rate. Consequently, a five-fold difference between the two factors is reasonable and the value calculated in equation (11) is thus an acceptable, conservative ground water-to-trench air volatilization factor.

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